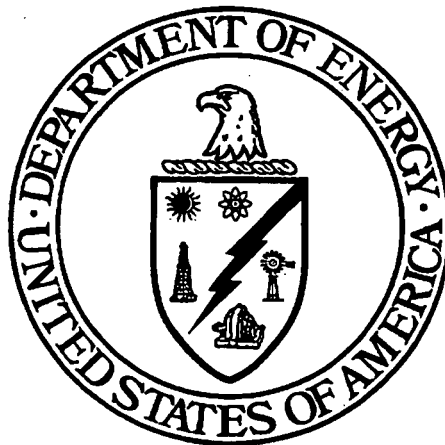


# **INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR SECOND QUARTER 1999**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
FERNALD, OHIO**



**SEPTEMBER 1999**

**U.S. DEPARTMENT OF ENERGY**

**51350-RP-0007**

**REV. 0**

**FINAL**

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AMS	air monitoring station
AMSL	above mean sea level
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
BTV	benchmark toxicity value
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
gpad	gallons per acre per day
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs	pounds
LCS	leachate collection system
LDS	leak detection system
MDC	minimum detectable concentration
mg/L	milligrams per liter
M gal	million gallons
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutant
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	on-site disposal facility
pCi/L	picoCuries per liter
pCi/m <sup>3</sup>	picoCuries per cubic meter
PRRS	Paddys Run Road Site
TLD	thermoluminescent dosimeter
WPRAP	Waste Pits Remedial Action Project
μg/L	micrograms per liter
μg/m <sup>3</sup>	micrograms per cubic meter

## 1.0 GROUNDWATER MONITORING UPDATE 2521

### 1.1 INTRODUCTION

This section summarizes the second quarter 1999 operational data for the aquifer remedy and first quarter 1999 analytical data from groundwater monitoring. This section is consistent with the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1, (DOE 1999b).

Figure 1-1 shows the sampling activities that contributed data to this section. Figure 1-2 identifies the IEMP groundwater monitoring wells by module/monitoring activity and Figure 1-3 shows the IEMP routine water-level (groundwater elevation) monitoring wells. Figure 1-4 shows the location of the active aquifer restoration modules and extraction/re-injection wells.

### 1.2 FINDINGS

Active groundwater restoration modules during the second quarter of 1999 include: South Field (Phase I) Extraction, South Plume, and Re-Injection Demonstration. The principal findings from the reporting period are summarized below.

#### Operational Summary

- **South Field (Phase I) Extraction Module:** The module target pumping rate for the combined nine active extraction wells was 1500 gallons per minute (gpm). Table 1-1 provides operational details for this module. Figures 1-5 through 1-13 present daily pumping rates, operational percentages for each well, and well outages lasting longer than 24 hours. As discussed in previous IEMP quarterly status reports, because Extraction Well 31566 is not being pumped, there is no daily pumping rate figure. Note that Extraction Well 31566 was shut down due to low uranium concentrations in August 1998 after consultation with the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA). Figure 1-14 provides the weekly total uranium concentrations for each extraction well in this module. For the majority of the period, all active extraction wells in the module were pumped at or above the rates specified in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a).
- **South Plume Module:** The South Plume Module target pumping rate was 2000 gpm. For the majority of the period, the six wells were pumped at or near the rates specified in the Baseline Remedial Strategy Report. Table 1-2 provides operational details for the South Plume Module. Figures 1-15 through 1-20 present daily pumping rates and

operational percentages for each well. Figure 1-21 depicts the weekly total uranium concentrations for each well in this module.

- Re-Injection Demonstration Module: The target re-injection rate for this module was 1000 gpm. Groundwater was re-injected through the five wells near the rates specified in the Baseline Remedial Strategy Report for the majority of the period. The monthly average module re-injection rate was significantly lower in April 1999 than in May or June due to planned maintenance activities. Table 1-3 provides operational details for this module and Figures 1-22 through 1-26 present daily re-injection rates and operational percentages for each well.
- Table 1-4 summarizes the operational data from the three active restoration modules for the second quarter of 1999. The South Plume and South Field (Phase I) Extraction Modules pumped a total of 437.53 million gallons of groundwater and removed 181.93 pounds of uranium during this reporting period. The Re-Injection Demonstration Module re-injected 117.14 million gallons of groundwater back into the aquifer for a net total extraction of 320.39 million gallons. To date, 4.79 billion gallons of groundwater have been pumped and 1175.34 pounds of uranium have been removed from the aquifer. During the second quarter of 1999, re-injection returned 7.15 pounds of uranium back into the aquifer. Figure 1-27 depicts the total groundwater pumped versus groundwater treated during the second quarter. Figure 1-28 shows the removal efficiencies for the South Field (Phase I) Extraction and South Plume Modules.

### Total Uranium Plume

- The total uranium plume map shown in Figure 1-29 was modified in the following three areas to account for higher uranium concentrations based on the first quarter 1999 data:
  - Monitoring Well 2060, which is located just south of Willey Road in about the center of the plume.
  - Monitoring Well 3069, which is located just north of Willey Road in the eastern half of the plume.
  - Direct push sample location 12408, which is located in the South Field area southeast of the Storm Water Retention Basin.
- Routine IEMP groundwater monitoring samples collected from Monitoring Wells 2060 and 3069 had total uranium concentration measurements (121 micrograms per liter [ $\mu\text{g/L}$ ] and 386  $\mu\text{g/L}$ , respectively) that were higher than what was previously measured (37  $\mu\text{g/L}$  and 209  $\mu\text{g/L}$ , respectively). The total uranium plume depicted in Figure 1-29 was re-contoured to honor the new data. Monitoring Well 2060 is now shown to be within the 100  $\mu\text{g/L}$  total uranium plume contour. Monitoring Well 3069 is now shown to be within the 300  $\mu\text{g/L}$  total uranium plume contour.

- The total uranium plume was re-contoured in the area just southeast of the Storm Water Retention Basin. The new contours account for total uranium concentration data as high as 184  $\mu\text{g/L}$  at location 12408 which had previously been mapped as below 20  $\mu\text{g/L}$ . The controlling document for the work was the Project Specific Plan for Conducting Direct-Push Sampling in the South Field Area (DOE 1999e). Data collected from this sampling effort is being used to refine the extent of the total uranium plume in the South Field area. Direct push samples collected at four additional locations in the first quarter of 1999 confirmed that the mapped portrayal of the plume was appropriate at these locations. Groundwater samples are collected at 10-foot depth increments beneath the water table until the base of the 20  $\mu\text{g/L}$  total uranium plume is defined.

The U.S. Department of Energy (DOE) transmitted the direct push sampling data to EPA and OEPA by facsimiles on June 4, 1999 (F:SWP[ARWWP]:99-0010); May 10, 1999 (F:SWP[ARWWP]:99-0008); April 19, 1999 (F:SWP[ARWWP]:99-0007); and April 12, 1999 (F:SWP[ARWWP]:99-0006). The sample data were discussed during the weekly site conference calls following submittal of each facsimile. The current direct push sampling activity will continue into, and is scheduled to be completed, during the second quarter of 1999.

- Two additional quarterly rounds of direct push groundwater sampling were conducted (December 1998 to January 1999 and March 1999) as part of the Re-Injection Demonstration at locations 12369, 12372, and 12373. Figure 1-30 profiles the total uranium concentration in cross section for data collected in late December 1998 and early January 1999. Figure 1-31 profiles the total uranium concentration in cross section for data collected in March 1999. These profiles are being used to show how the plume is changing over the course of the demonstration at those locations. For reference the screened interval of Re-Injection Well 22109 (located just up gradient from location 12369) has been added to the profiles. The next quarterly round will be collected in June 1999.
- The locations for two new South Field Module extraction wells (32446 and 32447) were selected in May. The selection was presented to EPA and OEPA by a facsimile on May 17, 1999 (F:SWP[ARWWP]:99-0008) and was discussed during the May 18, 1999 conference call. The locations of the new wells are identified on Figure 1-4. The installation of the two wells is scheduled to begin in August 1999. The need for the two new extraction wells was based on refined total uranium plume interpretations in the area and groundwater modeling results. The installation of these additional wells at this time is also necessary to support the accelerated aquifer remediation schedule.
- In December of 1998, the integrity of Waste Pit area Monitoring Well 2648 was compromised by surface remediation activities. As identified in the 1998 Integrated Site Environmental Report (DOE 1999a) and the Integrated Environmental Monitoring Status Report for First Quarter 1999 (DOE 1999c), for a short period of time (note refined dates: December 7, 1998 to February 2, 1999) surface water could have entered the well during storm events. Following repair of the well, three and 10 well

volumes of groundwater were pumped with the well being sampled for uranium after each pumping event. The uranium concentrations in the pumped groundwater measured 19 and 18  $\mu\text{g/L}$ , respectively.

### Groundwater Elevation Data and Capture Assessment

- Groundwater elevation measurements for the second quarter of 1999 were collected from April 19 to April 22, 1999. The measurements are contoured in Figures 1-32 and 1-33 for Type 2 and Type 3 monitoring wells, respectively. Detailed views of the contours at the South Plume Module are presented in Figures 1-34 and 1-35. Past experience at the Fernald Environmental Monitoring Project (FEMP) has shown that with the large number of wells (180) being measured each quarter, some measurement, transcription, or data entry errors occur (typically less than 5 percent). These errors often become apparent when the data are posted to maps and the contouring process begins. When the errors are identified, the erroneous data points are culled from the data set to be contoured in order to produce a water level map that represents aquifer conditions. The data that were culled during the review of the April data set are as follows:
  - The elevation measurement collected at Monitoring Well 2648 was considered suspect because it was about two feet or more lower than nearby wells.
  - The elevation measurement collected at Monitoring Well 22198 was considered suspect because it was about 4.5 feet lower than other wells in its' vicinity.
- Actual pumping rates for April 19 through 22, 1999, for each module, appear on Figures 1-32 and 1-33 to reflect pumping conditions during the period when elevations were measured.
- DOE proposes that detailed groundwater elevation maps, such as those presented in Figures 1-34 and 1-35 of this report, be discontinued beginning with the Integrated Environmental Monitoring Status Report for Third Quarter 1999. The basis for this proposal is that DOE no longer contours extraction well water levels on the maps. This removes intra-well drawdown effects from the contouring, thus reducing the "clutter" on the figures. It was the intra-well drawdown effects that caused tight contours (clutter) in the areas of the pumping wells. The detailed maps were needed to better distinguish the tight contour areas.
- DOE proposes to discontinue the measurement of water levels in Type 3 monitoring wells beginning in the third quarter of 1999 because of the absence of vertical hydraulic gradients at the FEMP. The general absence of vertical gradients between Type 2 and Type 3 monitoring wells was discussed in Appendix A.3, pages A.3-1 and A.3-2 of the 1998 Integrated Site Environmental Report. However, the text in Appendix A.3 did identify an apparent vertical gradient between Monitoring Wells 2398 and 3398 which, upon further investigation, has been determined to be non-existent. The 1998 differences between Monitoring Wells 2398 and 3398 were due to a re-surveying error (i.e., the monitoring well reference elevation was

incorrectly updated). Therefore it can now be concluded that there are no vertical hydraulic gradients between Type 2 and Type 3 wells at the FEMP.

- Capture of the main portion of the South Plume (north of the Paddys Run Road Site [PRRS] above the 20  $\mu\text{g/L}$  total uranium final remediation level [FRL]) continued during the second quarter of 1999 due to pumping of the South Plume Module (refer to Figures 1-32 through 1-35). Water elevations were measured on April 19 through 22, 1999). Extraction Well 3927 was down on April 22, 1999 for routine superchlorination treatment to address biofouling within and adjacent to the well screen.
- Analysis of the first quarter 1999 PRRS constituent samples for arsenic, phosphorus, potassium, and sodium indicates that capture of the total uranium plume is having a negligible influence on the PRRS plume. As shown in Table 1-5, most PRRS constituent concentrations were within the historical minimum-maximum range and were, in most cases, close to the statistical averages. The only result to exceed the historical maximum was for potassium at Monitoring Well 3900 (3.77 milligrams per liter [mg/L]); however, the value was qualified as a non-detectable estimate. In addition, no volatile organic compounds were detected in the monitoring wells used to evaluate the effects of the South Plume Module pumping on the PRRS plume.
- Groundwater flow direction measurements were taken with the colloidal borescope during the second quarter of 1999. However, DOE has determined that the borescope's camera and compass were misaligned during the instruments annual cleaning performed by the manufacturer during March of 1999 causing all subsequent flow direction measurements to be erroneous. This misalignment was identified in July and effects all borescope data collected after March 26, 1999. Therefore, second and third quarter borescope data are not considered representative and are not reported in the IEMP quarterly status reports. Furthermore, DOE is currently reassessing the role of the borescope monitoring program and its value to the overall evaluation of the FEMP's groundwater remedy. DOE will provide any recommendations or proposals for modifying the borescope monitoring program for agency consideration as part of the annual review of the IEMP.
- Monitoring Well 72433 was installed in the eastern South Field area during a Geoprobe® equipment demonstration in May 1999. This well has a 0.5 inch diameter pre-packed well screen and was installed using a Geoprobe® Advance 6600 system. This well is being added to the IEMP water level monitoring activity and therefore will be depicted on future water level maps.
- Figure 1-36 shows the predicted steady state groundwater elevations based on the groundwater model with the South Field (Phase 1) Extraction, Re-Injection Demonstration, and South Plume Modules operating as specified in the Baseline Remedial Strategy Report. For comparative purposes, the 10-year, uranium-based restoration footprint (capture zone), the first quarter 1999 total uranium plume outline, and the interpreted capture zones from the April Type 2 groundwater elevation map (Figure 1-32) are also shown on the figure. The modeled capture zone and the capture

zone derived from the April groundwater elevation measurements appear to be in good agreement.

#### Groundwater Model:

- Phase II of the groundwater model upgrade was initiated in the third quarter of 1999 with an anticipated finish date in mid-December 1999. As part of this phase, the groundwater flow model is being re-calibrated using a more recent groundwater level data set to bring model predictions more in line with observed groundwater flow. It is anticipated that the re-calibrated model will be an important tool for the evaluation of the groundwater remedy at the FEMP.

#### Non-Uranium FRL Exceedances

- As identified in the IEMP, Revision 1, DOE will report non-uranium FRL exceedances in the 1999 Integrated Site Environmental Report.

#### On-Site Disposal Facility Leak Detection Monitoring

##### Leachate Collection System and Leak Detection System Volumes:

- Volume from the leachate collection systems for the second quarter of 1999 are as follows: April (275,262 gallons); May (275,066 gallons); and June (287,887 gallons). Repairs to the leachate pipeline were completed and the line was brought back into service during the second quarter. It can be concluded that the impact of any leakage from the pipeline that may have reached the environment through the two identified containment pipe leaks was negligible. This conclusion is based on radiological surveys of, and soil samples from, the excavated areas. Radiological surveys were conducted during the excavation. These surveys showed no radioactivity above background levels. Soil samples were also collected to determine if leachate had been released into the environment. The soil was sampled at the excavations where leaks would have been most likely to occur based on pipe installation records and observations made during field investigations. Analytical results of the soil samples showed no indication of contamination in the environment. Additional information on the pipeline leaks can be found in the Soil and Disposal Facility Project-specific documentation.
- Volumes pumped from the leak detection systems, by cell, for the second quarter of 1999 are as follows: April (Cell 1: 133.2 gallons, Cell 2: 455.0 gallons); May (Cell 1: 0 gallons, Cell 2: 452.7 gallons); and June (Cell 1: 168.2 gallons, Cell 2: 962.2 gallons).
- Quantitative measurement of cell-specific leak detection system water accumulation rates began in May 1999 for the two active cells (Cells 1 and 2). These measurements are provided graphically on Figures 1-37 and 1-38 along with summary statistics for the quarter. The quarterly average accumulation rate for Cell 1 (0.52 gallons per acre per day [gpac]) is approximately an order of magnitude lower than the quarterly rate

for Cell 2 (4.5 gpad). This variation in accumulation rates is expected and is attributed to the amount of fill material in each cell. (Refer to the 1995 Workshop on Geosynthetic Clay Liners, National Risk Management Research Laboratory Office of Research and Development [Appendix F, page F-6 ]) (EPA 1995). The accumulation rate measurements indicate that the liner systems for Cells 1 and 2 are performing as designed in that the accumulation rates are far below the on-site disposal facility design-established initial response leakage rate of 20 gpad.

#### Analytical Sampling Status:

- Sampling continues to be conducted as specified in the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan (DOE 1997b). Figure 1-39 identifies the well locations. The first quarter 1999 detected constituents and their comparison to previous rounds is provided below for the leachate collection system (LCS), LDS, perched groundwater (as sampled via horizontal till wells), and Great Miami Aquifer groundwater.

#### Status for Cell 1:

- On April 5 1999, DOE transmitted responses to EPA and OEPA comments on the Draft Technical Memorandum For the On-Site Disposal Facility Cell 1 Baseline Groundwater Conditions. Two additional comments on the responses were received from OEPA in late May. These additional comments are scheduled to be addressed in the third quarter of 1999.
- For the first quarter of 1999, the following samples were collected: one sample each of leachate (location 12338C) and LDS water (location 12338D); and a baseline sampling event for perched groundwater (Horizontal Till Well 12338), and quarterly samples from the upgradient Great Miami Aquifer (Monitoring Well 22201) and downgradient Great Miami Aquifer (Monitoring Well 22198). Detected results are provided in Table 1-6.
  - Monitored constituents in samples from the LCS were non-detectable except for boron (2.8 mg/L) and total organic halogens (0.00716 mg/L). Trend analysis will be performed annually on the data collected from this system and will be provided in IEMP annual integrated site environmental reports.
  - Monitored constituents in samples from the LDS were non-detectable except for boron (0.276 mg/L), total organic halogens (0.0166 mg/L), and total uranium (20.17  $\mu$ g/L). Trend analysis will be performed annually on the data collected from this system and will be provided in IEMP annual integrated site environmental reports.
  - Monitored constituents in samples from the horizontal till well were non-detectable except for boron (0.0247 mg/L).

- Monitored constituents in samples from the upgradient Great Miami Aquifer Monitoring Well 22201 were non-detectable except for boron (0.109 mg/L) and total uranium (0.194  $\mu\text{g/L}$ ).
- Monitored constituents in samples from the downgradient Great Miami Aquifer Monitoring Well 22198 were non-detectable except for boron (0.0503 mg/L), total organic carbon (3.56 mg/L), and total uranium (0.809  $\mu\text{g/L}$ ).

Status for Cell 2:

- For the first quarter of 1999, the following samples were collected: one sample each of leachate (location 12339C) and LDS water (location 12339D); and a baseline sampling event occurred for perched groundwater (Horizontal Till Well 12339), upgradient Great Miami Aquifer Monitoring Well 22200, and downgradient Great Miami Aquifer Monitoring Well 22199. Detected results are provided in Table 1-7.
- Monitored constituents in samples from the LCS were non-detectable except for boron (0.66 mg/L) and total uranium (22.022  $\mu\text{g/L}$ ). Trend analysis will be performed annually on the data collected from this system and will be provided in IEMP annual integrated site environmental reports.
- Monitored constituents in samples from the LDS were non-detectable except for boron (2.22 mg/L), total organic carbon (8.19 mg/L), and total uranium (50.37  $\mu\text{g/L}$ ). Trend analysis will be performed annually on the data collected from this system and will be provided in IEMP annual integrated site environmental reports. Note that the uranium concentration is down from the December 1998 high of 71  $\mu\text{g/L}$  indicating that the residual contamination from the water that backed-up in the system is being flushed out. In May 1999, DOE initiated more frequent sampling of the LDS water for uranium concentration to provide additional information on this important system. This sampling occurs each time the LDS inner containment vessel is pumped out. The additional uranium data indicate a continued decline in the Cell 2 LDS uranium concentration to 15.7  $\mu\text{g/L}$  on June 29 1999.
- Monitored constituents in samples from the horizontal till well were non-detectable except for boron (0.0432 mg/L), total organic carbon (3.04 mg/L), and total organic halogens (0.0385 mg/L).
- Monitored constituents in samples from the upgradient Great Miami Aquifer well were non-detectable except for boron (0.0465 mg/L) and total organic carbon (7.84 mg/L).
- Monitored constituents in samples from the downgradient Great Miami Aquifer well were non-detectable except for boron (0.0404 mg/L), total organic halogens (0.0272 mg/L), and total uranium (1.41  $\mu\text{g/L}$ ).

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Status for Cell 3:

- For the first quarter of 1999, the following samples were collected: three baseline sampling events occurred for perched groundwater (Horizontal Till Well 12340), upgradient Great Miami Aquifer Monitoring Well 22203, and downgradient Great Miami Aquifer Monitoring Well 22204. Detected results are provided in Table 1-8.
  - Monitored constituents in samples from the horizontal till well were non-detectable except for boron, total organic halogens, and total uranium.
  - Monitored constituents in samples from the upgradient Great Miami Aquifer well were non-detectable except for boron, total organic halogens, and total uranium.
  - Monitored constituents in samples from the downgradient Great Miami Aquifer well were non-detectable except for boron, total organic halogens, and total uranium.

Figure 1-40 shows the groundwater monitoring activities to be summarized in the next IEMP quarterly status report. This next quarterly status report will be submitted in December 1999. The report will contain operational data and the plume capture assessment from July through September 1999 (third quarter), and analytical results from sampling activities conducted from April through June 1999 (second quarter).

TABLE 1-1

**SOUTH FIELD (PHASE 1) EXTRACTION MODULE  
OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER  
(APRIL THROUGH JUNE 1999)**

Extraction Well	31565	31564	31566 <sup>a,b</sup>	31563	31567	31550	31560	31561	31562	32276
Baseline Remedial Strategy Report Target Pumping Rates (gpm)										
	200	200	200	200	100	100	100	100	100	200
Monthly Average Well Pumping Rates (gpm)										
April	203	203	0	201	113	114	110	97	199	293
May	184	177	0	184	93	90	99	91	183	271
June	<u>201</u>	<u>201</u>	<u>0</u>	<u>203</u>	<u>100</u>	<u>105</u>	<u>102</u>	<u>100</u>	<u>201</u>	<u>303</u>
Quarterly Average	196	194	0	196	102	103	104	96	194	289
Monthly Average Well Concentrations for Total Uranium (µg/L)										
April	14.5	14.4	7.1	36.4	38.4	77.4	109.0	37.5	97.3	179.5
May	14.9	14.4	9.7	37.0	40.9	66.3	90.0	42.9	120.1	161.2
June	<u>15.1</u>	<u>14.3</u>	<u>5.0</u>	<u>34.4</u>	<u>36.5</u>	<u>70.7</u>	<u>97.9</u>	<u>36.3</u>	<u>113.6</u>	<u>176.8</u>
Quarterly Average	14.8	14.4	7.3	35.9	38.6	71.5	99.0	38.9	110.3	172.5
Monthly Average Well Efficiencies (Pounds of Total Uranium Removed/Million Gallons Pumped)										
April	0.12	0.12	NA	0.30	0.32	0.65	0.91	0.31	0.81	1.50
May	0.12	0.12	NA	0.31	0.34	0.55	0.75	0.36	1.00	1.34
June	<u>0.13</u>	<u>0.12</u>	<u>NA</u>	<u>0.29</u>	<u>0.30</u>	<u>0.59</u>	<u>0.82</u>	<u>0.30</u>	<u>0.95</u>	<u>1.47</u>
Quarterly Average	0.12	0.12	NA	0.30	0.32	0.60	0.83	0.32	0.92	1.44
<div> <div>Monthly Average Module Pumping Rate (gpm)</div> <div>Water Pumped by Extraction Module (M gal)</div> <div>Monthly Total Uranium Concentration from Extraction Module<sup>c</sup> (µg/L)</div> </div>										
April	1533			66.32			74.3			
May	1372			61.18			73.1			
June	<u>1516</u>			<u>65.33</u>			<u>75.2</u>			
Quarterly Average	1474			Total	192.83		Quarterly Average	74.2		

<sup>a</sup>Extraction Well 31566 was shut down in April, May, and June.<sup>b</sup>NA = not applicable<sup>c</sup>Average is calculated from individual well concentrations and flow rates.

**TABLE 1-2**  
**SOUTH PLUME MODULE**  
**OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER**  
**(APRIL THROUGH JUNE 1999)**

Extraction Well	3924	3925	3926	3927	32308	32309
Baseline Remedial Strategy Report Target Pumping Rates (gpm)						
	300	300	400	400	250	250
Monthly Average Well Pumping Rates (gpm)						
April	291	288	376	465	225	225
May	284	283	362	464	224	212
June	<u>276</u>	<u>275</u>	<u>376</u>	<u>484</u>	<u>246</u>	<u>245</u>
Quarterly Average	284	282	371	471	232	227
Monthly Average Well Concentrations for Total Uranium (µg/L)						
April	38.9	35.2	21.3	1.3	70.0	68.1
May	33.4	35.4	21.0	1.6	60.9	59.3
June	<u>29.1</u>	<u>32.0</u>	<u>19.6</u>	<u>1.3</u>	<u>68.3</u>	<u>65.9</u>
Quarterly Average	33.8	34.2	20.6	1.4	66.4	64.4
Monthly Average Well Efficiencies (Pounds of Total Uranium Removed/Million Gallons Pumped)						
April	0.32	0.29	0.18	0.01	0.58	0.57
May	0.28	0.30	0.18	0.01	0.51	0.49
June	<u>0.24</u>	<u>0.27</u>	<u>0.16</u>	<u>0.01</u>	<u>0.57</u>	<u>0.55</u>
Quarterly Average	0.28	0.29	0.17	0.01	0.55	0.54
Monthly Average Module Pumping Rate (gpm)						
April	1871					
May	1829					
June	<u>1902</u>					
Quarterly Average	1867					
Water Pumped by Extraction Module (M gal)						
April			81.02			
May			81.59			
June			<u>82.09</u>			
Quarterly Average			Total 244.70			
Monthly Total Uranium Concentration from Extraction Module <sup>a</sup> (µg/L)						
April					32.7	
May					29.6	
June					<u>30.4</u>	
Quarterly Average					Quarterly Average 30.9	

<sup>a</sup>Average is calculated from individual well concentrations and flow rates.

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TABLE 1-3

**RE-INJECTION DEMONSTRATION MODULE  
OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER  
(APRIL THROUGH JUNE 1999)**

Re-Injection Well	22107	22108	22109	22240	22111
Baseline Remedial Strategy Report Target Re-Injections Rates (gpm)					
	200	200	200	200	200
Monthly Average Well Re-Injection Rates (gpm)					
April	179	154	123	174	176
May	167	175	185	187	186
June	<u>195</u>	<u>195</u>	<u>194</u>	<u>195</u>	<u>195</u>
Quarterly Average	180	175	167	185	186
Monthly Average Module Re-Injection Rate (gpm)				Water Re-Injected by Module (M gal)	
April	808			34.97	
May	901			40.15	
June	<u>974</u>			<u>42.02</u>	
Quarterly Average	894			Total	117.14

**TABLE 1-4**  
**AQUIFER RESTORATION SYSTEM**  
**OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER**  
**(APRIL THROUGH JUNE 1999)**

	Gallons Pumped/Re-Injected this Reporting Period (M gal)	Total Uranium Removed/Re-Injected this Reporting Period <sup>a</sup> (lbs)	Average System Efficiency this Reporting Period <sup>a</sup> (lbs/M gal)	Gallons Pumped/Re-Injected from August 1993 to June 1999 (M gal)	Total Uranium Removed/Re-Injected from August 1993 to June 1999 <sup>a</sup> (lbs)	System Efficiency from August 1993 to June 1999 <sup>a</sup> (lbs/M gal)
South Field (Phase 1) Extraction Module	192.83	119.20	0.62	720.489	472.64	0.66
South Plume Module	244.70	62.73	0.26	4,068.444	702.70	0.17
Re-Injection Demonstration Module	117.14	7.15	NA	344.401	NA	NA
Aquifer Restoration System Totals						
(pumped)	437.53	181.93	0.42	4,788.933	1175.34	0.25
(re-injected)	117.14	7.15	NA	344.401	7.15 <sup>b</sup>	NA
(net)	320.39	174.78	NA	4,444.532	1169.19 <sup>b</sup>	NA

<sup>a</sup>NA = not applicable

<sup>b</sup>Only includes current period re-injection data, will be updated for the next IEMP with all available re-injection data since the start of re-injection

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TABLE 1-5

## PADDYS RUN ROAD SITE GROUNDWATER SUMMARY STATISTICS

	Sampling Period						Results with Detections for First Quarter 1999	
	January 1, 1988 - March 31, 1999							
	Monitoring Well	Number of Samples <sup>a,b,c</sup>	Min. <sup>a,b,c,d</sup> (mg/L)	Max. <sup>a,b,c,d</sup> (mg/L)	Avg. <sup>a,b,c,d</sup> (mg/L)	SD <sup>a,b,c,d</sup> (mg/L)	Sample Result (mg/L)	Validation Qualifier <sup>e</sup>
Arsenic	2128	208	0.0006	0.1876	0.013	0.02	0.0007	-
	2625	198	0.0048	0.05	0.012	0.008	0.0106	-
	2636	170	0.01	0.0939	0.04	0.02	0.0887	-
	2898	24	0.00035	0.0063	0.016	0.0013	0.0024	U
	2899	23	0.00032	0.003	0.0013	0.0008	0.00064	U
	2900	206	0.00032	0.0548	0.0051	0.0051	0.00064	U
	3128	26	0.00085	0.234	0.012	0.046	0.0078	-
	3636	25	0.00075	0.014	0.0021	0.0026	0.0015	-
	3898	23	0.0006	0.0062	0.002	0.0012	0.0012	U
	3899	24	0.00032	0.003	0.0013	0.0008	0.00064	U
3900	24	0.000395	0.0045	0.0023	0.0010	0.00079	U	
Phosphorus	2128	34	0.04	16.2	2	3	0.64	-
	2625	23	0.307	12.3	3.23	3.23	2.83	-
	2636	22	9.6	170	93	50	146	-
	2898	25	0.005	1.05	0.09	0.2	0.02	-
	2899	22	0.005	0.11	0.04	0.03	0.07	U
	2900	23	0.07	0.96	0.5	0.26	0.37	-
	3128	33	0.005	13	0.45	2.3	0.1	U
	3636	24	0.0125	1.1	0.11	0.22	0.05	U
	3898	22	0.00955	1.24	0.13	0.26	0.0191	U
	3899	23	0.00955	0.83	0.14	0.18	0.0191	U
3900	24	0.005	1.26	0.1	0.25	0.0191	U	

TABLE 1-5  
(Continued)

Sampling Period								
January 1, 1988 - March 31, 1999							Results with Detections for First Quarter 1999	
	Monitoring Well	Number of Samples <sup>a,b,c</sup>	Min. <sup>a,b,c,d</sup> (mg/L)	Max. <sup>a,b,c,d</sup> (mg/L)	Avg. <sup>a,b,c,d</sup> (mg/L)	SD <sup>a,b,c,d</sup> (mg/L)	Sample Result (mg/L)	Validation Qualifier <sup>e</sup>
Potassium	2128	26	1.09	18	4.2	4.8	2.67	J
	2625	23	0.64	6.26	3.4	1.7	2.54	J
	2636	22	8.51	218	81.3	55.7	88.9	-
	2898	25	1.11	5.05	3.57	0.789	2.22	UJ
	2899	23	1.36	4.42	3.52	0.608	4.04	-
	2900	24	0.0095	6	1.7	1.2	0.019	UJ
	3128	26	1.09	3.7	2.5	0.62	1.73	J
	3636	24	1.09	4.24	2.54	0.604	2.24	-
	3898	23	0.61	3.93	2.2	0.73	1.88	UJ
	3899	24	1.335	3.22	2.43	0.339	2.59	-
	3900	24	0.975	3.19	1.90	0.530	3.77	UJ
Sodium	2128	26	22.9	75.2	38.5	12.8	34.1	-
	2625	23	16.5	50.7	33.9	8.05	32.6	-
	2636	22	23	79.9	48	16	26.3	-
	2898	25	4.945	29.2	18.4	4.87	9.89	U
	2899	23	11.2	22.9	17.2	3.25	17.2	-
	2900	24	0.01355	43.3	29.1	10.0	0.0271	U
	3128	26	3.56	13.4	6.92	3.35	3.56	-
	3636	24	4.65	13	8.3	2.9	4.7	-
	3898	23	7.29	14.6	8.99	1.74	22.2	U
	3899	24	6.24	12.1	8.80	1.43	8.85	-
	3900	24	4.45	10.8	6.44	1.85	13	U

<sup>a</sup>The data are based on unfiltered samples from the Operable Unit 5 remedial investigation/feasibility study data set (1988 through 1993) and 1994 through 1999 groundwater data.

<sup>b</sup>If more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the total number of samples, and the sample with the maximum concentration is used for determining the summary statistics (minimum, maximum, average, and standard deviation [SD]).

<sup>c</sup>Rejected data qualified with either a R or Z were not included in this count or the summary statistics.

<sup>d</sup>For results where the concentrations are below the detection limit, the results used in the summary statistics are each set at half the detection limit.

<sup>e</sup>Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998).

TABLE 1-6

**ON-SITE DISPOSAL FACILITY CELL 1 FREQUENCY AND RANGE OF DETECTED CONSTITUENTS  
FOR FIRST QUARTER 1999**

Constituent (FRL) <sup>a</sup>	LCS <sup>b,c,d,e</sup> (12338C)		LDS <sup>b,c,d,e</sup> (12338D)		HTW <sup>b,c,d,e</sup> (12338)		Great Miami Aquifer			
							Upgradient <sup>b,c,d</sup> (22201)		Downgradient <sup>b,c,d</sup> (22198)	
	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range
	No. of Samples		No. of Samples		No. of Samples		No. of Samples		No. of Samples	
	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.
Total Organic Carbon (NA mg/L)	4/5 1	ND to 123 ND	3/4 1	ND to 80.9 ND	19/20 1	ND to 12.2 ND	19/20 1	ND to 59.7 ND	18/20 1	ND to 52.5 3.56
Total Organic Halogens (NA mg/L)	4/5 1	ND to 0.049 0.00716	3/4 1	ND to 0.0426 0.0166	9/19 1	ND to 0.077 ND	12/20 1	ND to 0.078 ND	7/20 1	ND to 0.0526 ND
Boron (0.33 mg/L)	6/6 1	0.0642 to 2.8 2.8	4/4 1	0.0296 to 0.321 0.276	16/20 1	ND to 0.685 0.0247	15/20 1	ND to 0.142 0.109	14/18 1	ND to 0.116 0.0503
Total Uranium (20 µg/L)	4/5 1	ND to 119 ND	4/4 1	1.5 to 20.17 20.17	19/20 1	ND to 19 ND	18/20 1	ND to 5.196 0.194	20/20 1	0.57 to 3.12 0.809

Note: Highlighting identifies first quarter information.

<sup>a</sup>From Operable Unit 5 Record of Decision, Table 9-4

<sup>b</sup>If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.

<sup>c</sup>Rejected data qualified with either a R or Z were not used in this comparison.

<sup>d</sup>ND = not detected

<sup>e</sup>LCS = leachate collection system

LDS = leak detection system

HTW = Horizontal Till Well

**TABLE 1-7**  
**ON-SITE DISPOSAL FACILITY CELL 2 FREQUENCY AND RANGE OF DETECTED CONSTITUENTS**  
**FOR FIRST QUARTER 1999**

Constituent (FRL) <sup>a</sup>	LCS <sup>b,c,d,e</sup> (12339C)		LDS <sup>b,c,d,e</sup> (12339D)		HTW <sup>b,c,d,e</sup> (12339)		Great Miami Aquifer			
	No. of Samples with Detections		No. of Samples with Detections		No. of Samples with Detections		Upgradient <sup>b,c,d</sup> (22200)		Downgradient <sup>b,c,d</sup> (22199)	
	Range		Range		Range		Range		Range	
	No. of Samples	Max. Result for 1st Qtr.	No. of Samples	Max. Result for 1st Qtr.	No. of Samples	Max. Result for 1st Qtr.	No. of Samples	Max. Result for 1st Qtr.	No. of Samples	Max. Result for 1st Qtr.
Total Organic Carbon (NA mg/L)	1/2	ND to 2.44	2/2	4.23 to 8.19	18/18	0.57 to 4.22	14/15	ND to 47.6	12/15	ND to 51.8
	<u>1</u>	<u>ND</u>	<u>1</u>	<u>8.19</u>	<u>1</u>	<u>3.04</u>	<u>1</u>	<u>7.84</u>	<u>1</u>	<u>ND</u>
Total Organic Halogens (NA mg/L)	1/2	ND to 0.0119	1/2	ND to 0.0205	13/18	ND to 0.0612	7/15	ND to 0.124	7/15	ND to 0.0386
	<u>1</u>	<u>ND</u>	<u>1</u>	<u>ND</u>	<u>1</u>	<u>0.0385</u>	<u>1</u>	<u>ND</u>	<u>1</u>	<u>0.0272</u>
Boron (0.33 mg/L)	2/3	ND to 0.786	2/2	0.904 to 2.22	10/18	ND to 0.0829	9/15	ND to 0.158	9/15	ND to 0.0569
	<u>1</u>	<u>0.66</u>	<u>1</u>	<u>2.22</u>	<u>1</u>	<u>0.0432</u>	<u>1</u>	<u>0.0465</u>	<u>1</u>	<u>0.0404</u>
Total Uranium (20 µg/L)	2/2	17.1 to 22.022	2/2	50.37 to 71	18/19	ND to 3.607	11/15	ND to 1.11	15/15	0.259 to 11.826
	<u>1</u>	<u>22.022</u>	<u>1</u>	<u>50.37</u>	<u>1</u>	<u>ND</u>	<u>1</u>	<u>ND</u>	<u>1</u>	<u>1.41</u>

Note: Highlighting identifies first quarter information.

<sup>a</sup>From Operable Unit 5 Record of Decision, Table 9-4

<sup>b</sup>If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.

<sup>c</sup>Rejected data qualified with either a R or Z were not used in this comparison.

<sup>d</sup>ND = not detected

<sup>e</sup>LCS = leachate collection system

LDS = leak detection system

HTW = Horizontal Till Well

**TABLE 1-8**  
**ON-SITE DISPOSAL FACILITY CELL 3 FREQUENCY AND RANGE OF DETECTED CONSTITUENTS**  
**FOR FIRST QUARTER 1999**

Constituent (FRL) <sup>a</sup>	HTW <sup>b,c,d,e</sup> (12340)		Great Miami Aquifer			
			Upgradient <sup>b,c,d</sup> (22203)		Downgradient <sup>b,c,d</sup> (22204)	
	No. of Samples with Detections	Range	No. of Samples with Detections	Range	No. of Samples with Detections	Range
	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.	No. of Samples for 1st Qtr.	Max. Result for 1st Qtr.
Total Organic Halogens (NA mg/L)	7/9 3	ND to 0.04 0.04	4/8 3	ND to 0.0171 0.01	4/8 3	ND to 0.03 0.03
Boron (0.33 mg/L)	6/9 3	ND to 0.0848 0.077	4/8 3	ND to 0.0776 0.039	3/8 3	ND to 0.0416 0.0395
Total Uranium (20 µg/L)	7/9 3	ND to 9.14 5.409	7/8 3	ND to 0.559 0.224	8/8 3	0.301 to 2.995 0.513

Note: Highlighting identifies first quarter information.

<sup>a</sup>From Operable Unit 5 Record of Decision, Table 9-4

<sup>b</sup>If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.

<sup>c</sup>Rejected data qualified with either a R or Z were not used in this comparison.

<sup>d</sup>ND = not detected

<sup>e</sup>HTW = Horizontal Till Well

FIGURE 1-1

GROUNDWATER SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

**SAMPLING ACTIVITIES**

South Plume Module:  
Operational  
Aquifer Conditions

South Field Extraction Module:  
Operational (Phase 1)  
Aquifer Conditions

Re-Injection Demonstration Module<sup>a</sup>:  
Operational

Waste Storage Area Module:  
Aquifer Conditions

Plant 6 Area Module:  
Aquifer Conditions

Routine Water-Level/Flow Direction Monitoring

RCRA Property Boundary Monitoring

Private Well Monitoring

KC-2 Warehouse Monitoring

OSDF Groundwater Monitoring:

Cell 1

Cell 2

Cell 3

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	◆		◆	◆	◆						
		◆	◆	◆	◆						
			◆	◆	◆						
			◆								
			◆								
◆											
◆											
◆	◆	◆									

◆ Data summarized/evaluated  
in this report

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FINAL

<sup>a</sup>Aquifer conditions for this module are monitored under the South Plume Module, South Field Module, RCRA Property Boundary Program, and Geoprobe® sampling results.

V:\55\GP1\mod\mod\gdt\2\99\gdt2004.dgn

STATE PLANNING COORDINATE SYSTEM 1983

20-SEP-1999

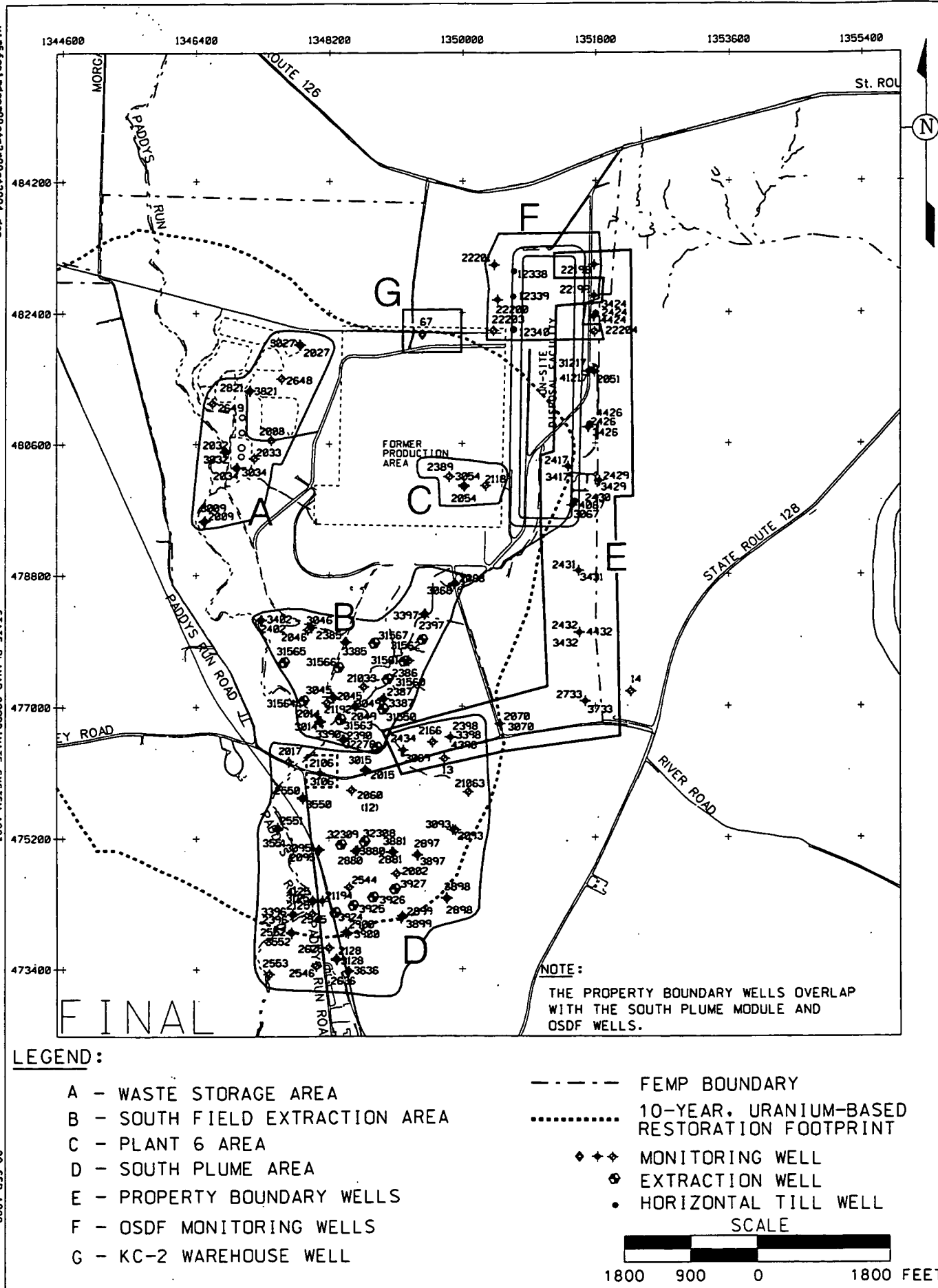


FIGURE 1-2. IEMP WATER QUALITY MONITORING WELLS AND EXTRACTION WELLS

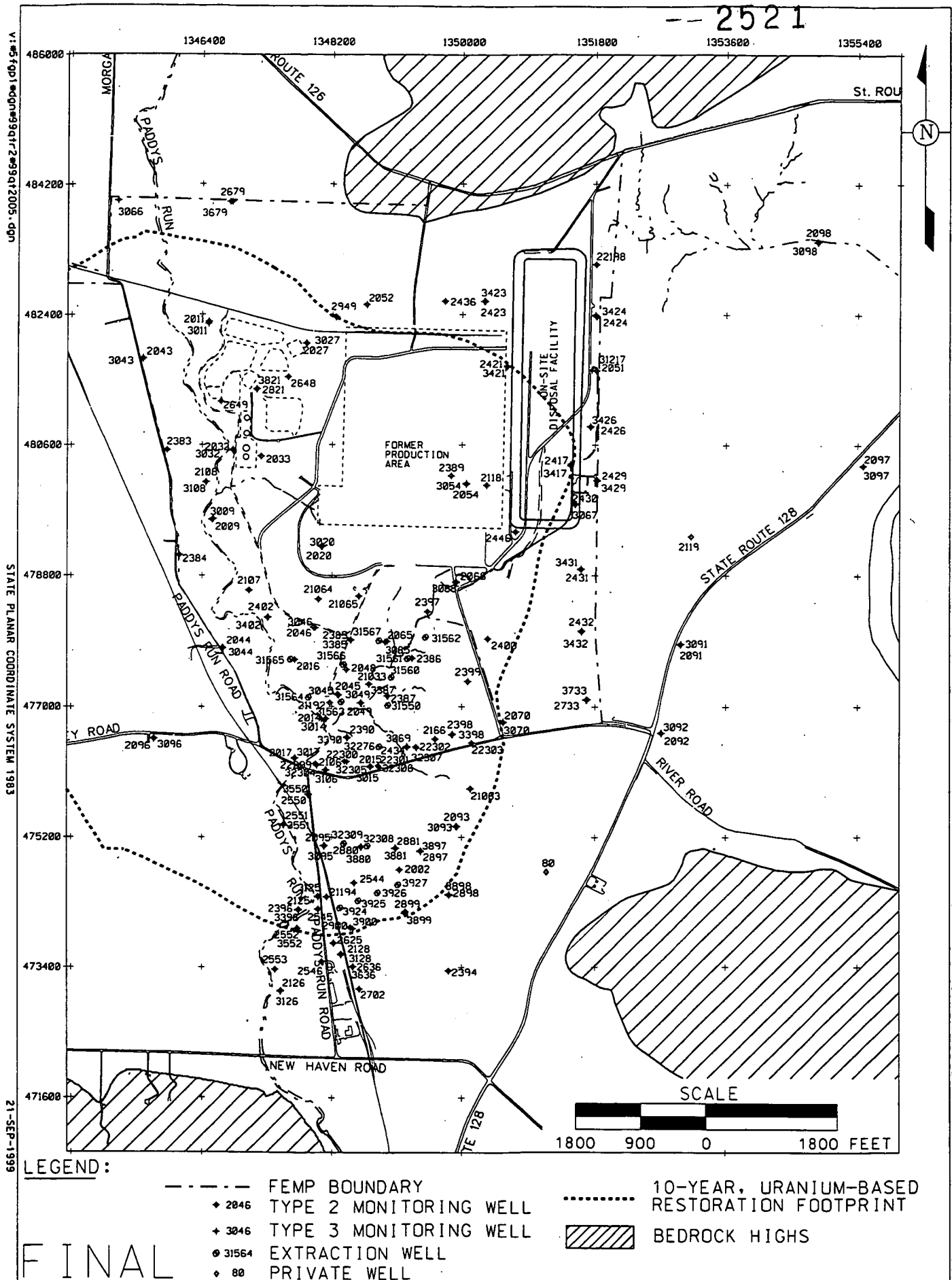


FIGURE 1-3. GROUNDWATER ELEVATION MONITORING WELLS

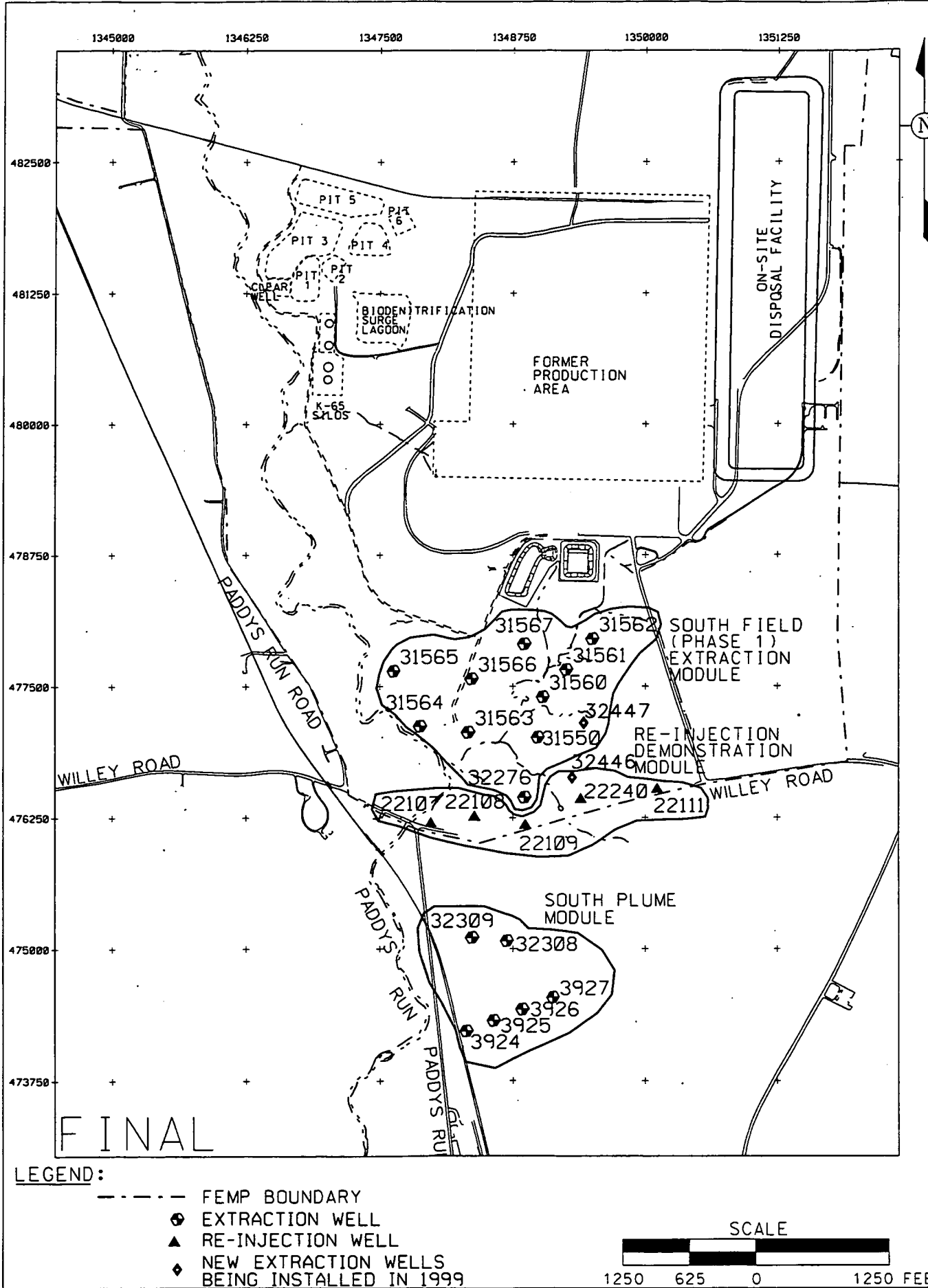


FIGURE 1-4. LOCATION OF ACTIVE AQUIFER RESTORATION MODULES

Hours in reporting period: 2199  
Hours pumped: 2128  
Hours not pumped: 72  
Operational percent: 96.8

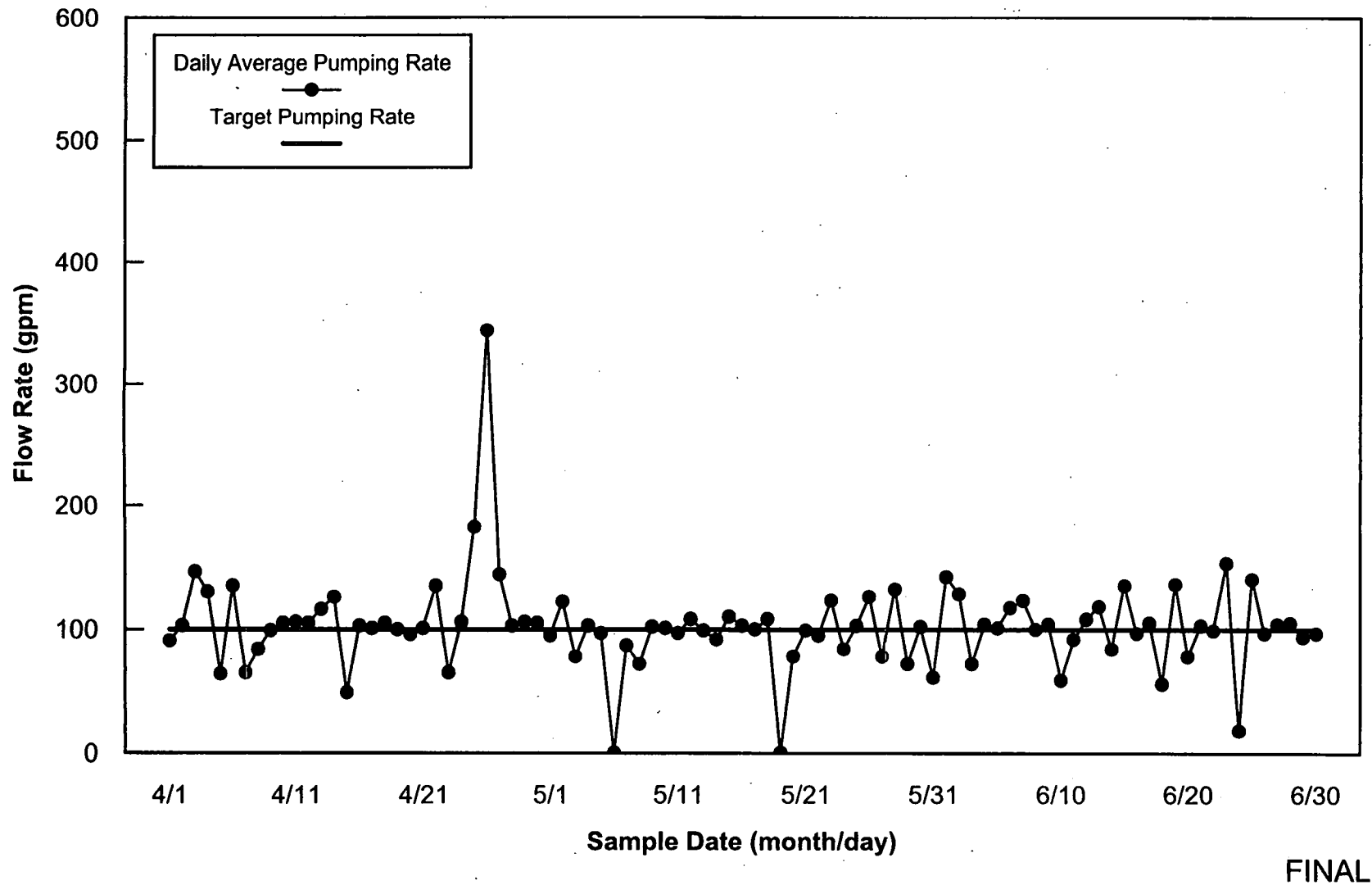


FIGURE 1-5. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD  
(PHASE 1) EXTRACTION WELL 31550, 4/99 - 6/99

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Hours in reporting period: 2170  
 Hours pumped: 2086  
 Hours not pumped: 84  
 Operational percent: 96.2

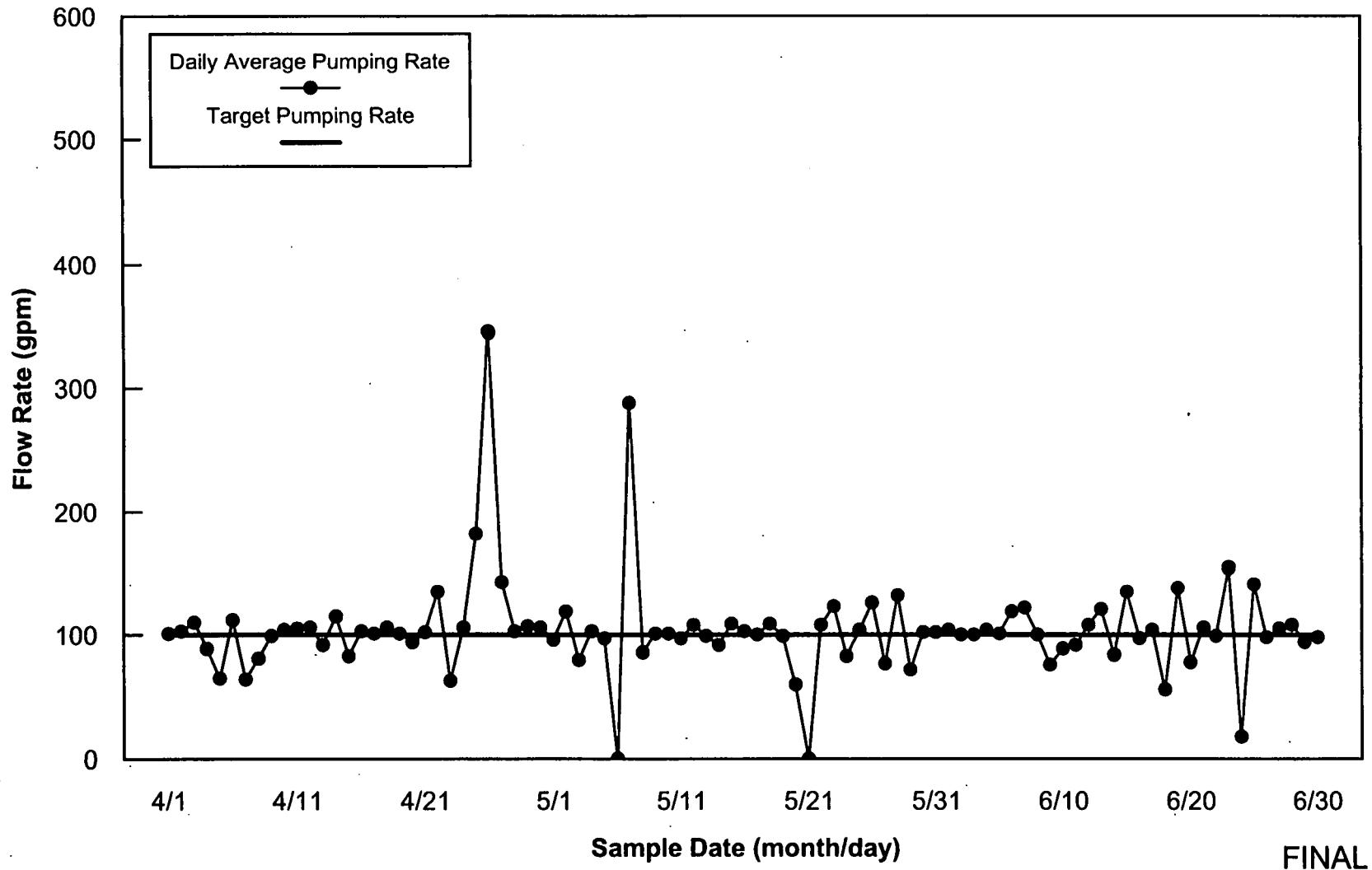
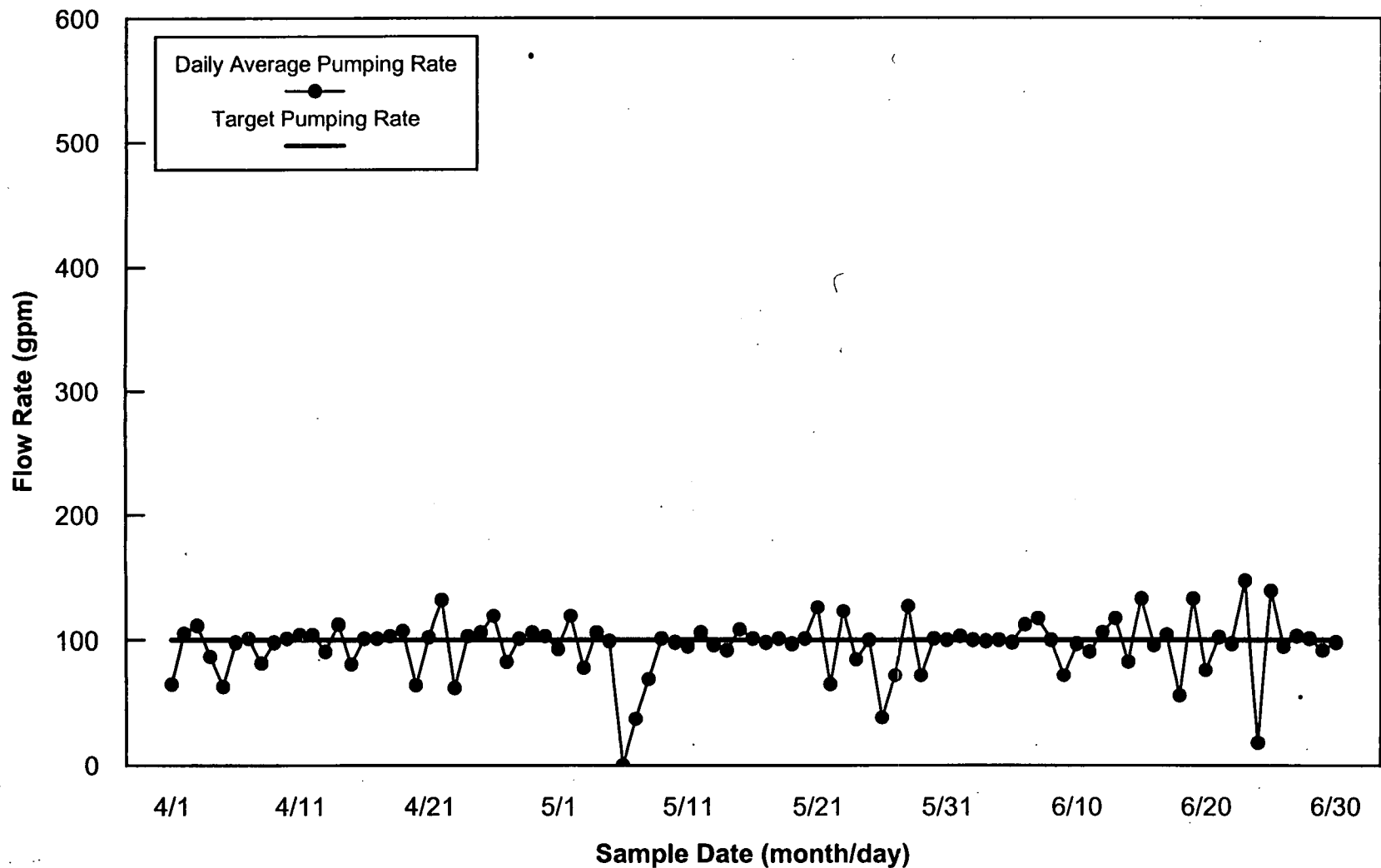


FIGURE 1-6. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD

Hours in reporting period: 2174  
Hours pumped: 2100  
Hours not pumped: 74  
Operational percent: 96.6



FINAL

2521

FIGURE 1-7. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD  
(PHASE 1) EXTRACTION WELL 31561, 4/99 - 6/99

33

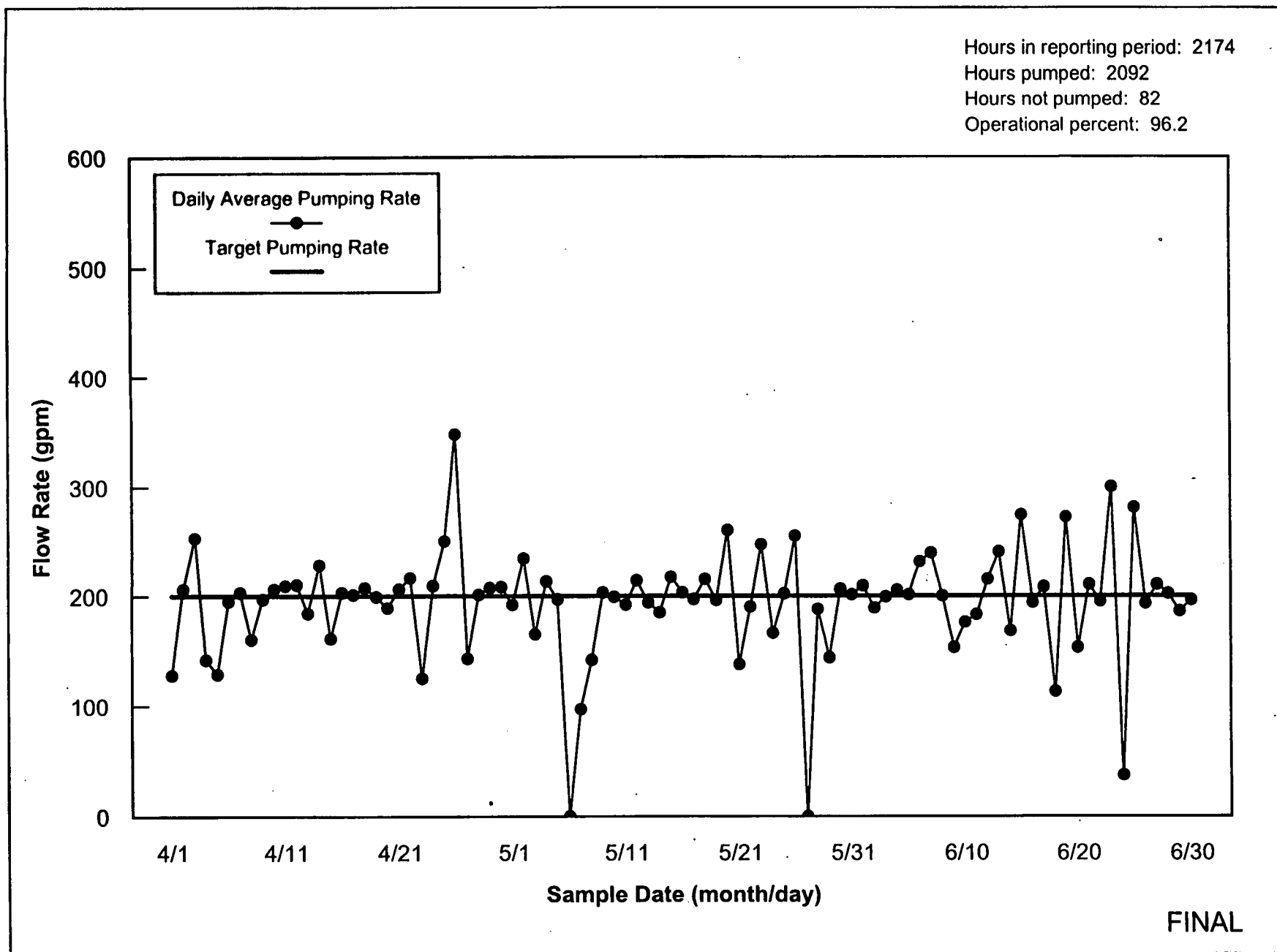
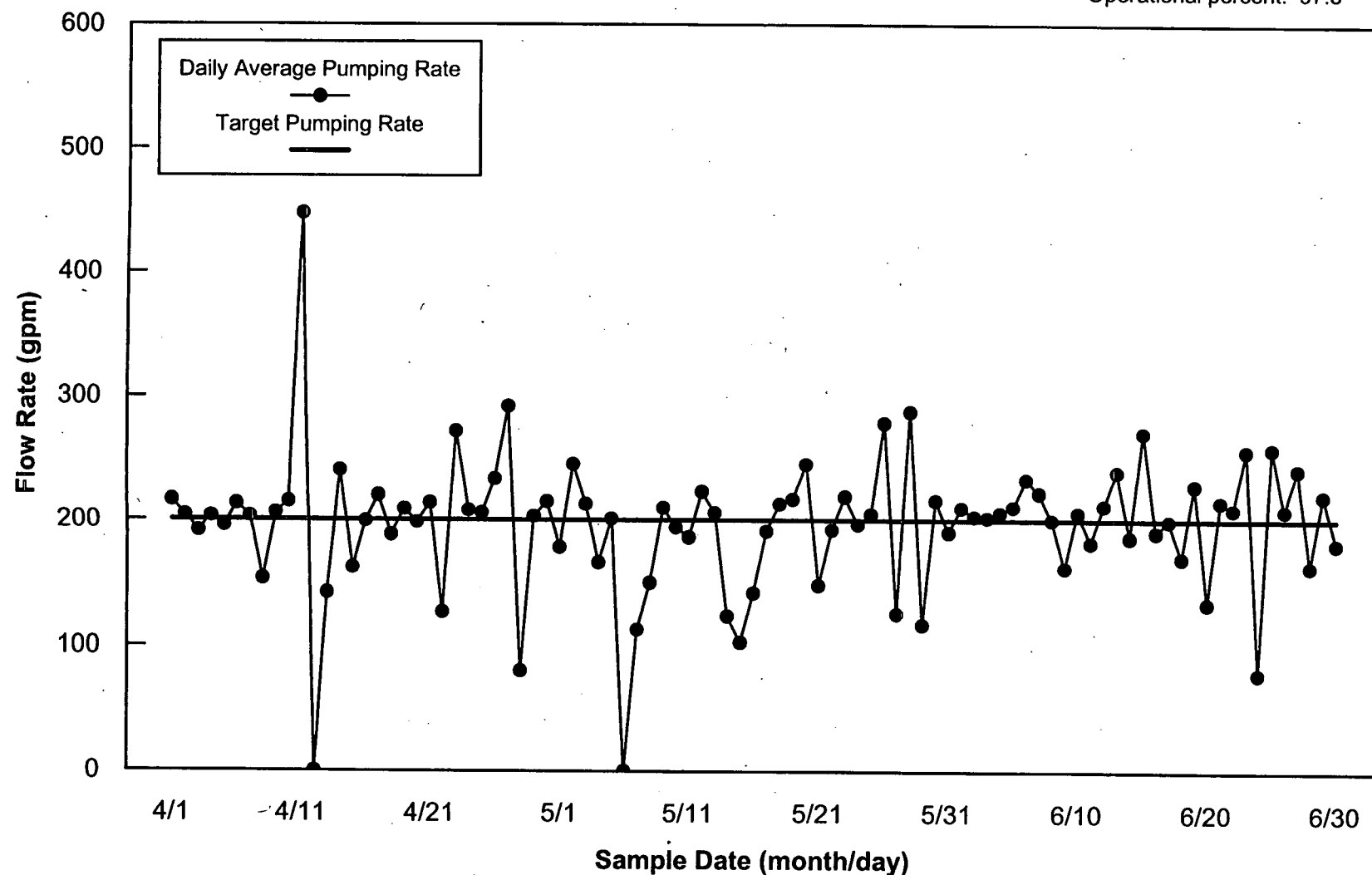


FIGURE 1-8. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD

34

Hours in reporting period: 2183  
 Hours pumped: 2125  
 Hours not pumped: 58  
 Operational percent: 97.3

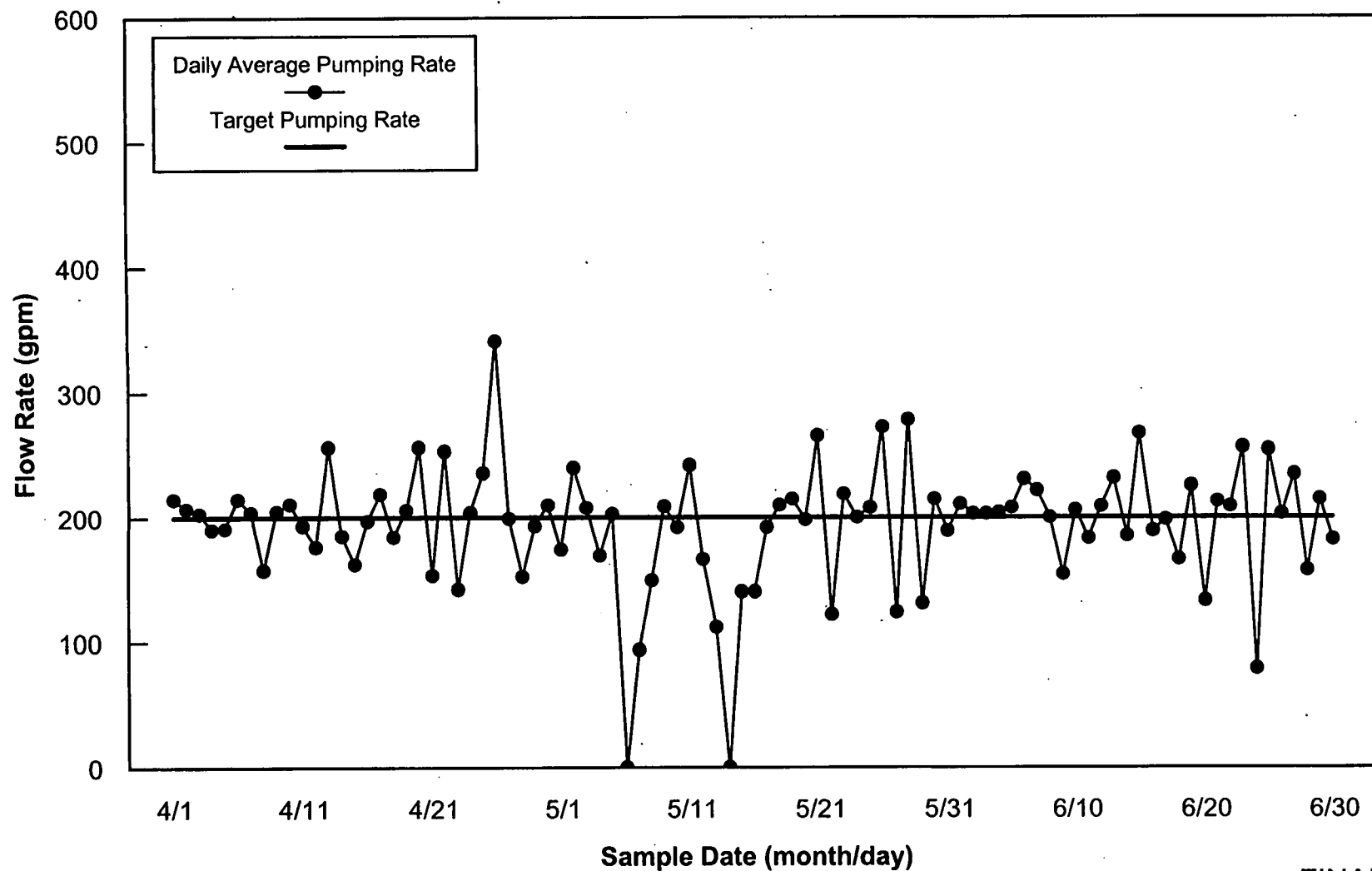


FINAL

FIGURE 1-9. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD  
 (PHASE 1) EXTRACTION WELL 31563, 4/99 - 6/99

58

Hours in reporting period: 2183  
 Hours pumped: 2075  
 Hours not pumped: 109  
 Operational percent: 95.0



FINAL

FIGURE 1-10. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD

Hours in reporting period: 2183  
Hours pumped: 2114  
Hours not pumped: 69  
Operational percent: 96.9

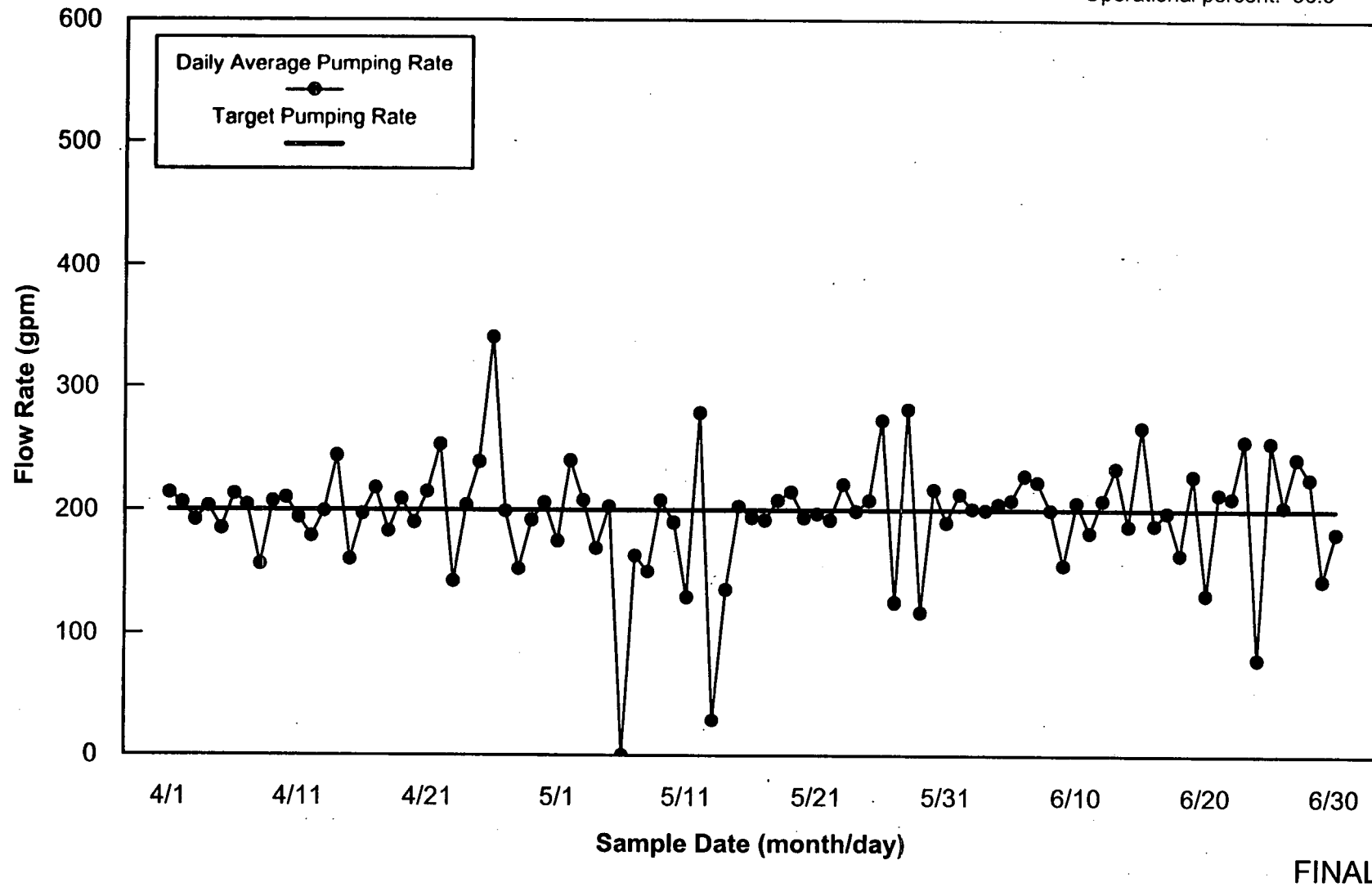
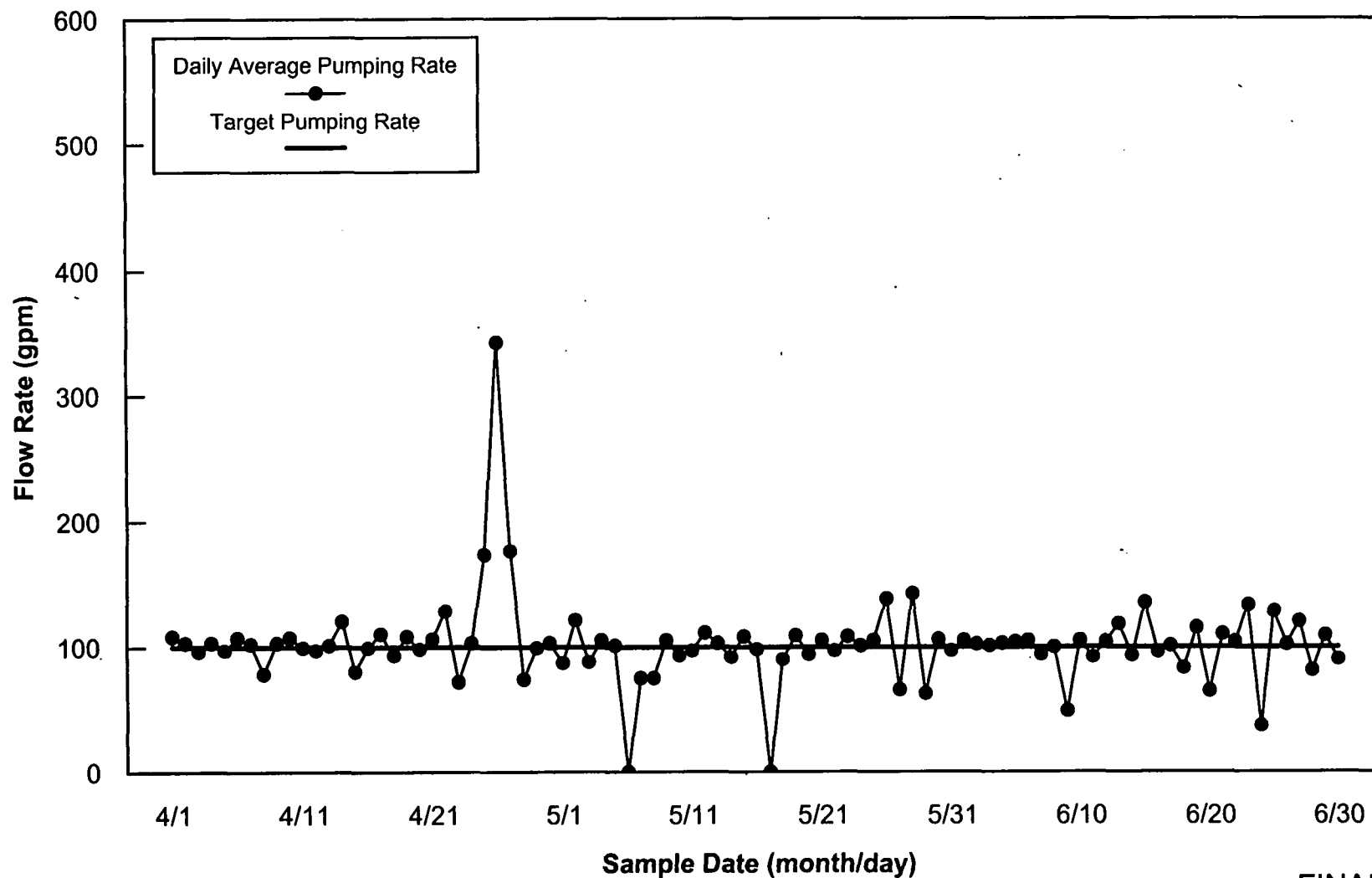


FIGURE 1-11. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD  
(PHASE 1) EXTRACTION WELL 31565, 4/99 - 6/99

37

Hours in reporting period: 2183  
 Hours pumped: 2106  
 Hours not pumped: 77  
 Operational percent: 96.5



FINAL

FIGURE 1-12. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD

Hours in reporting period: 2183  
Hours pumped: 2089  
Hours not pumped: 93  
Operational percent: 95.7

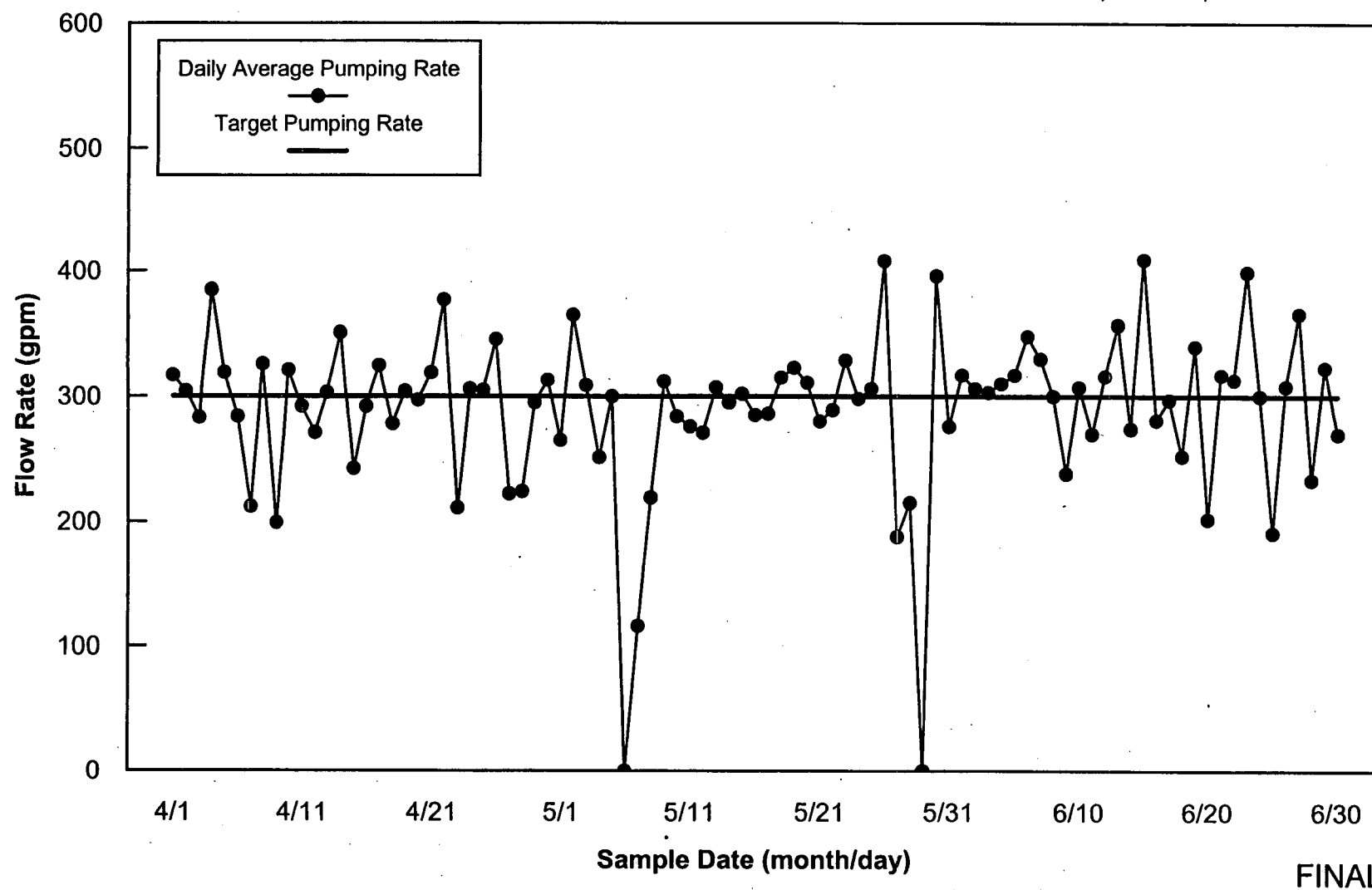
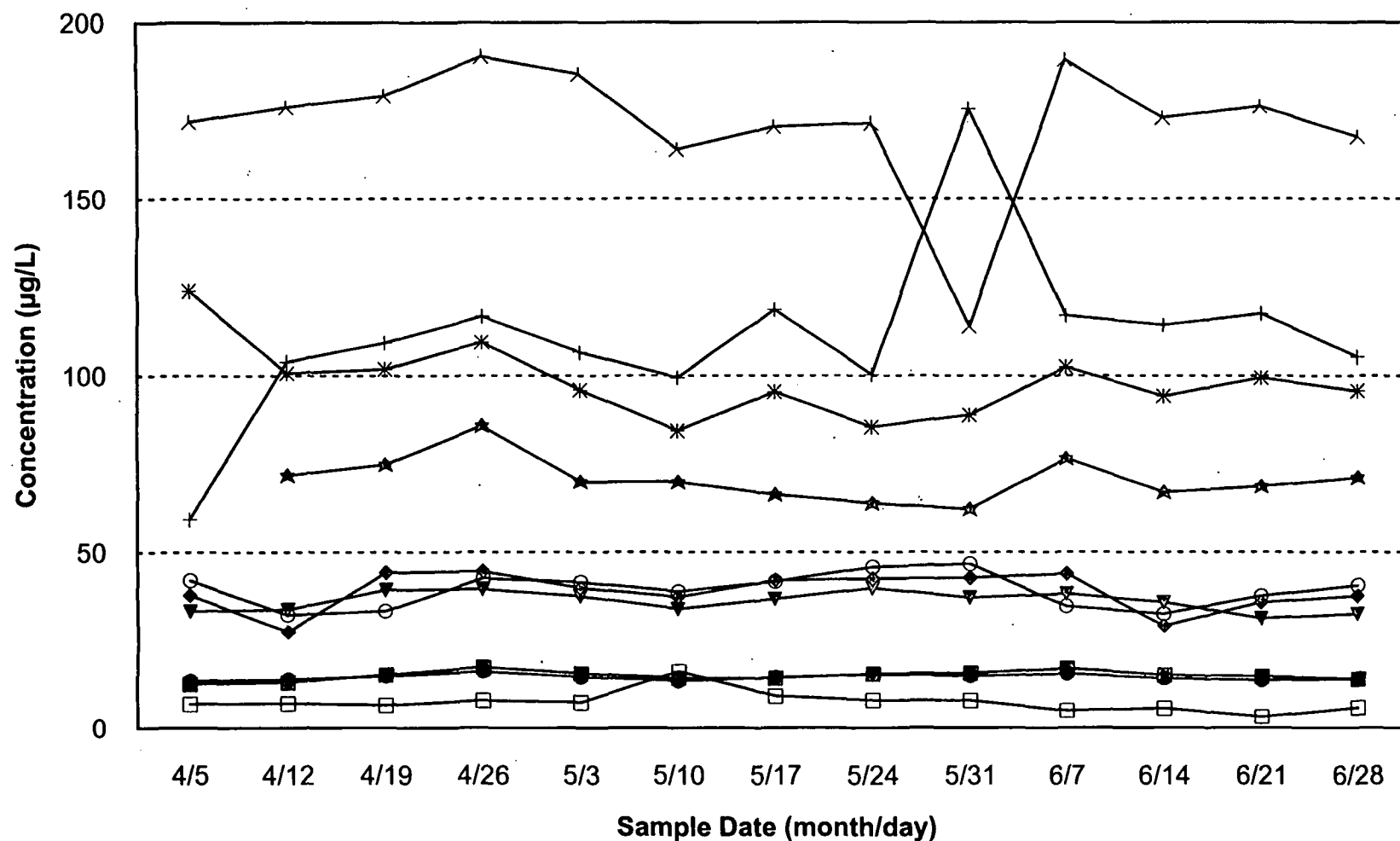


FIGURE 1-13. DAILY AVERAGE PUMPING RATES FOR SOUTH FIELD  
(PHASE 1) EXTRACTION WELL 32276, 4/99 - 6/99

39



Note: The 5/31 results from Extraction Wells 32276 and 31562 appear to be suspect.

- 31565    ◆ 31567    ○ 31561
- 31564    ★ 31550    + 31562
- 31566    \* 31560    × 32276
- ▼ 31563

FINAL

FIGURE 1-14. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH FIELD (PHASE 1) EXTRACTION MODULE

Hours in reporting period: 2185  
Hours pumped: 2093  
Hours not pumped: 92  
Operational percent: 95.8

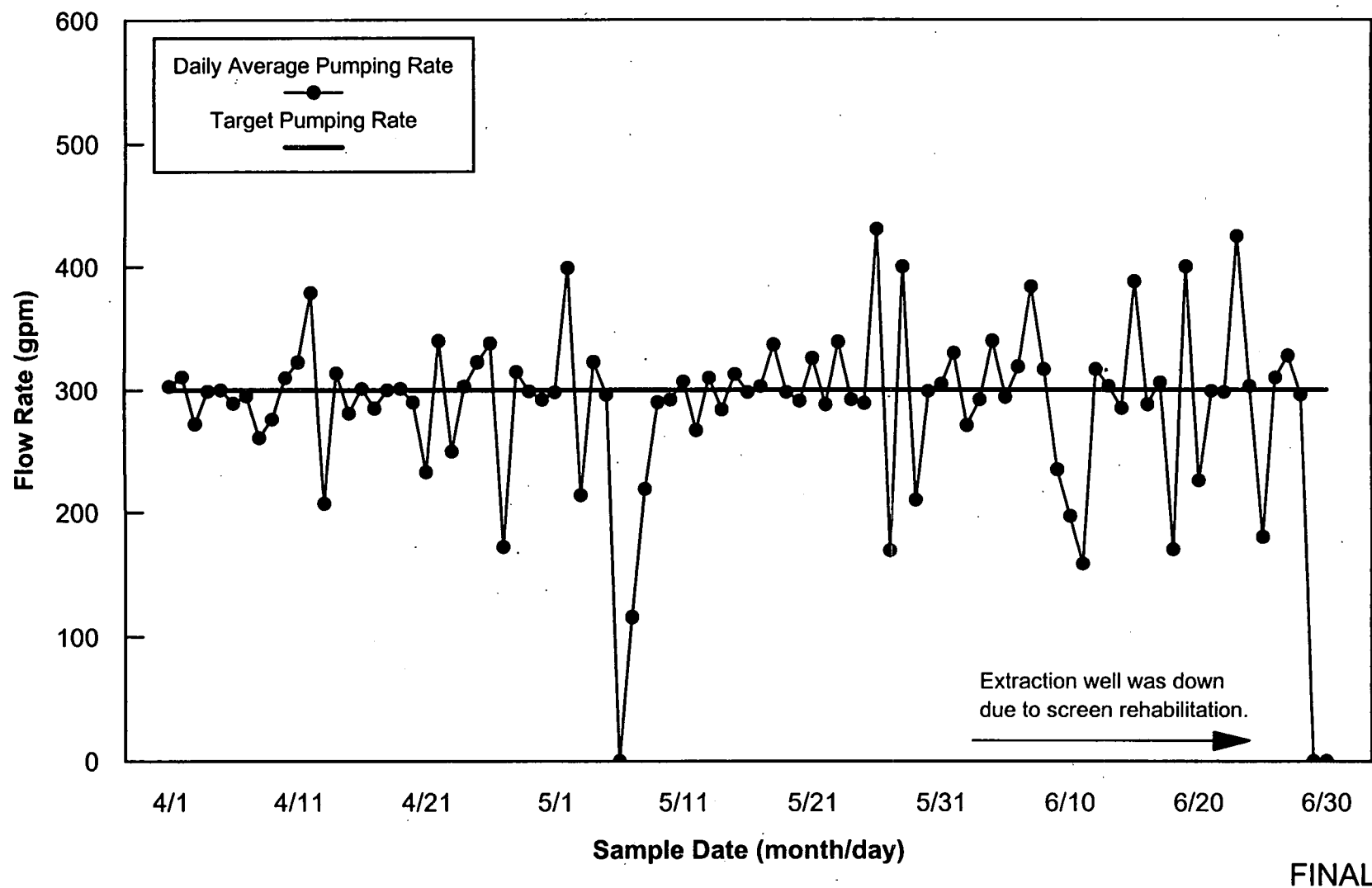


FIGURE 1-15. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME  
EXTRACTION WELL 3924, 4/99 - 6/99

117

Hours in reporting period: 2185  
Hours pumped: 2074  
Hours not pumped: 111  
Operational percent: 94.9

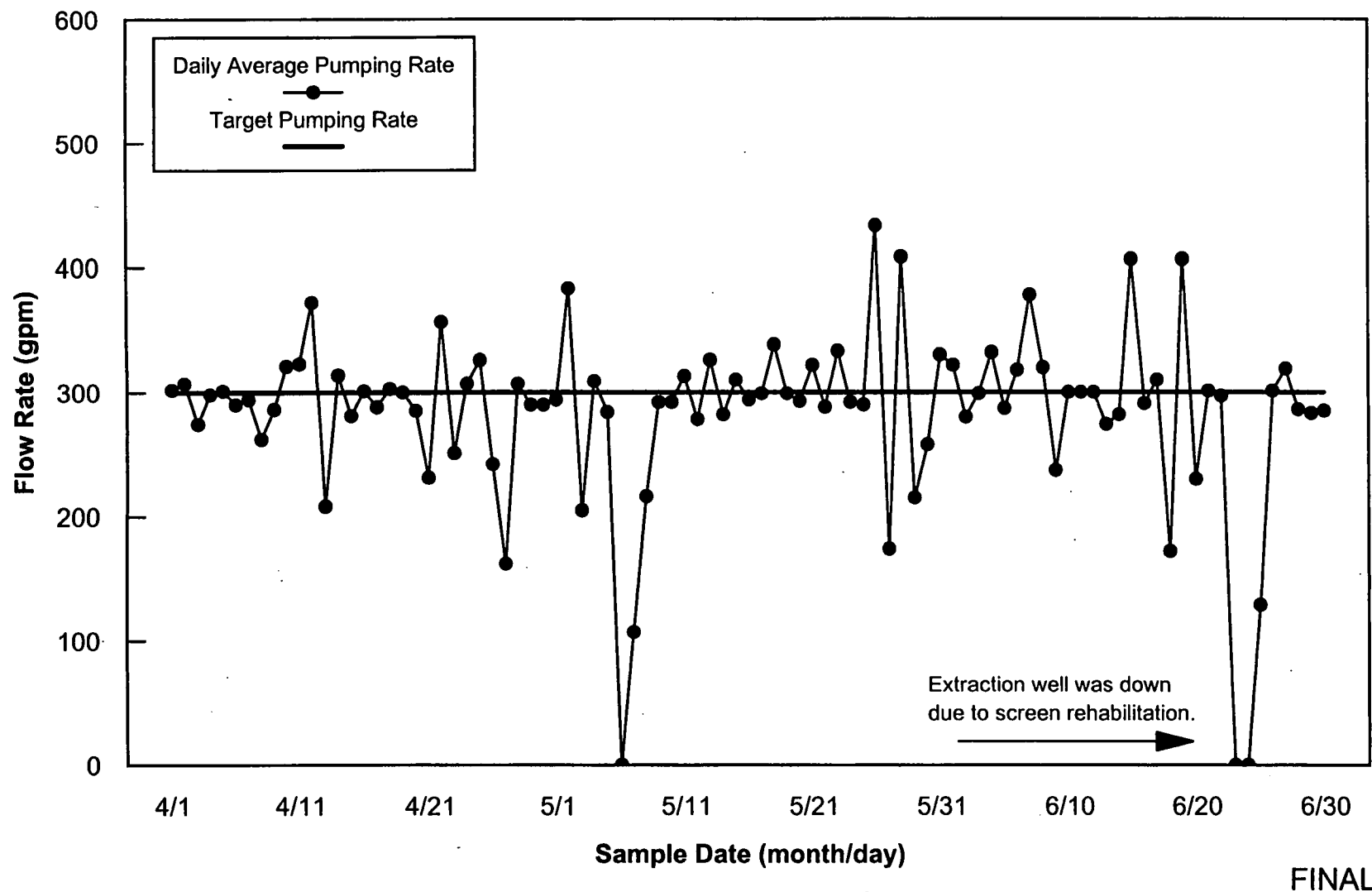
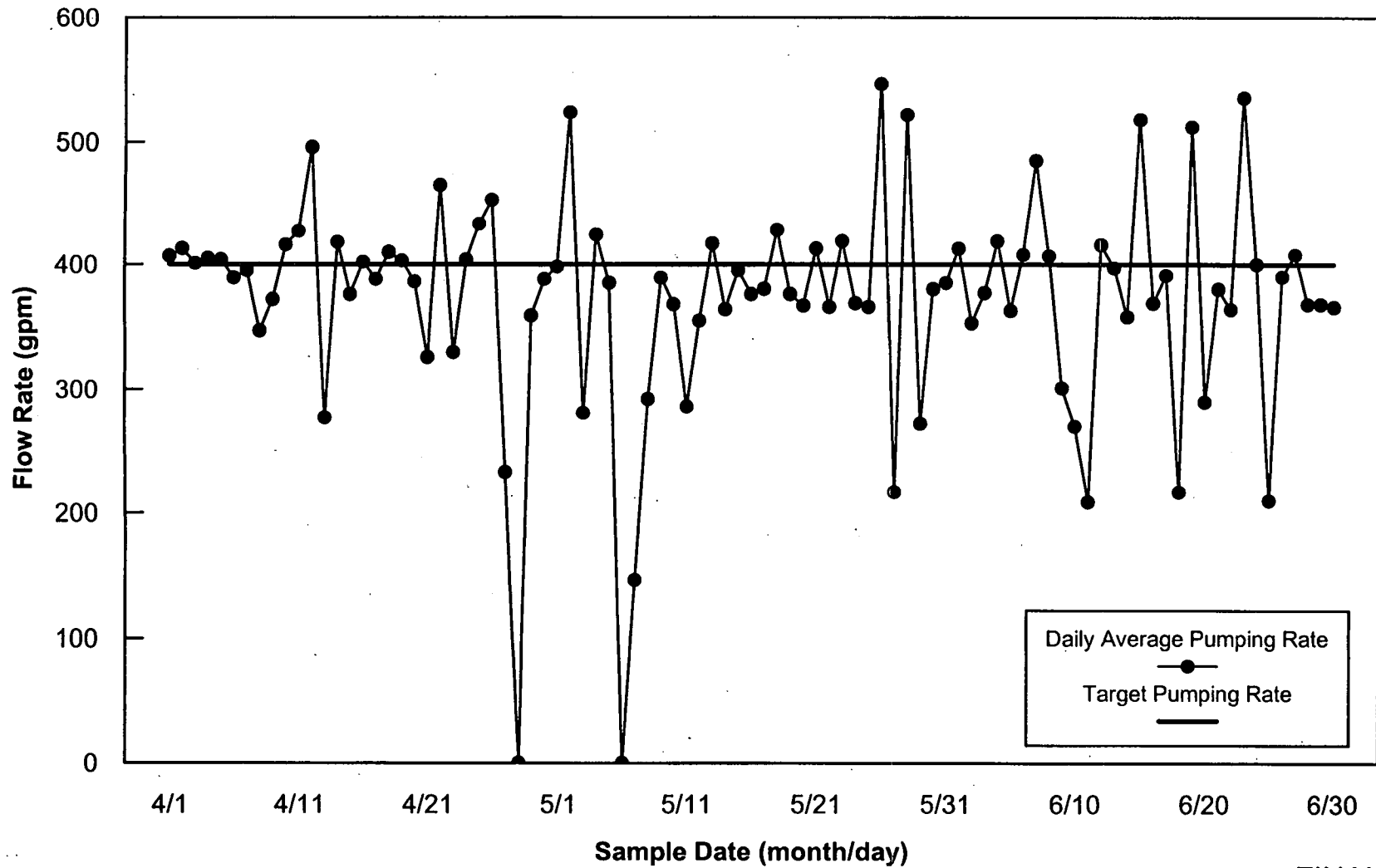


FIGURE 1-16. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME

EXTRACTION WELL 2005 4/01 - 6/30

Ch

Hours in reporting period: 2185  
 Hours pumped: 2094  
 Hours not pumped: 91  
 Operational percent: 95.8



FINAL

FIGURE 1-17. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME  
 EXTRACTION WELL 3926, 4/99 - 6/99

43

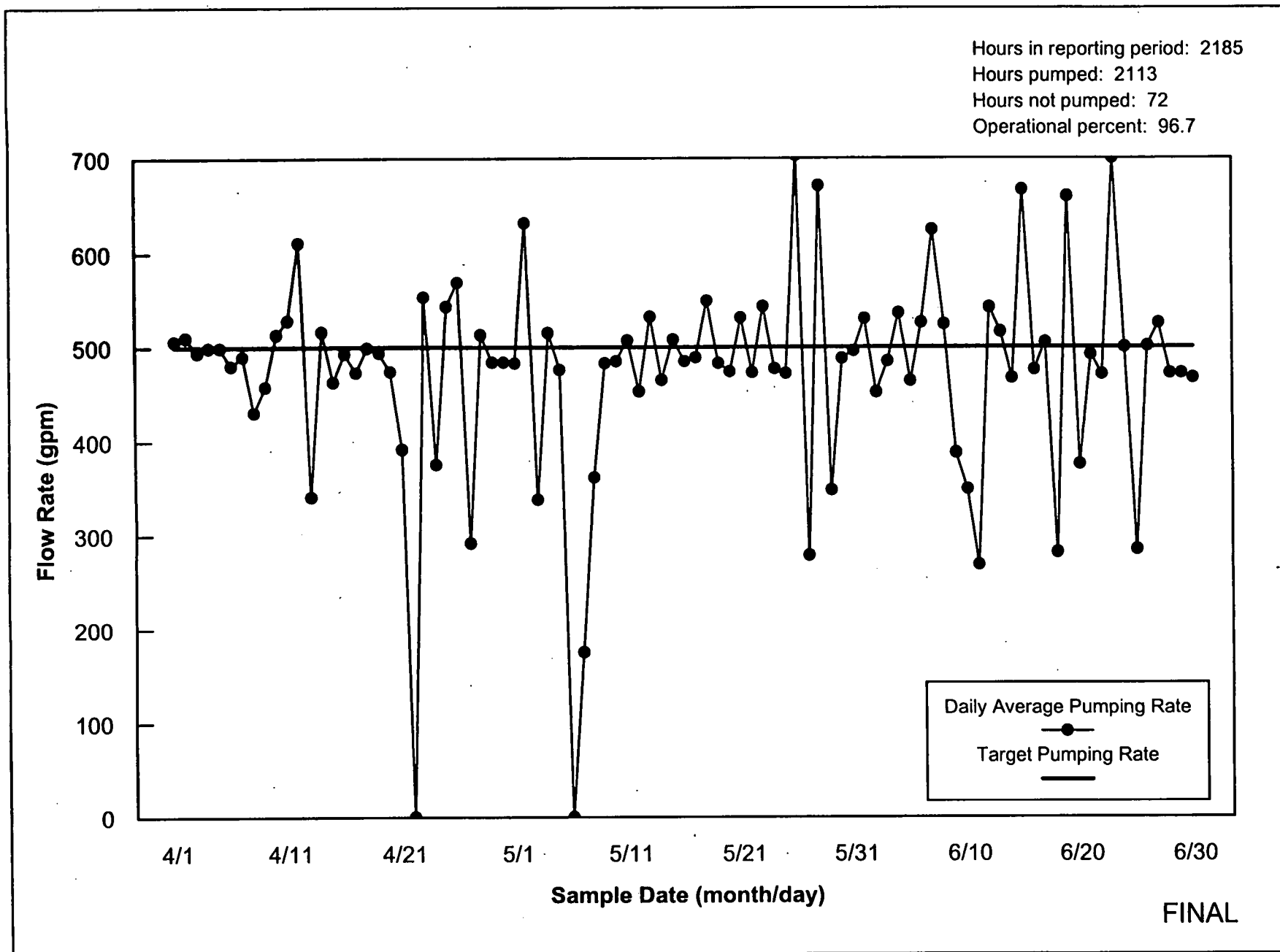


FIGURE 1-18. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME

Hours in reporting period: 2185  
Hours pumped: 2047  
Hours not pumped: 138  
Operational percent: 93.7

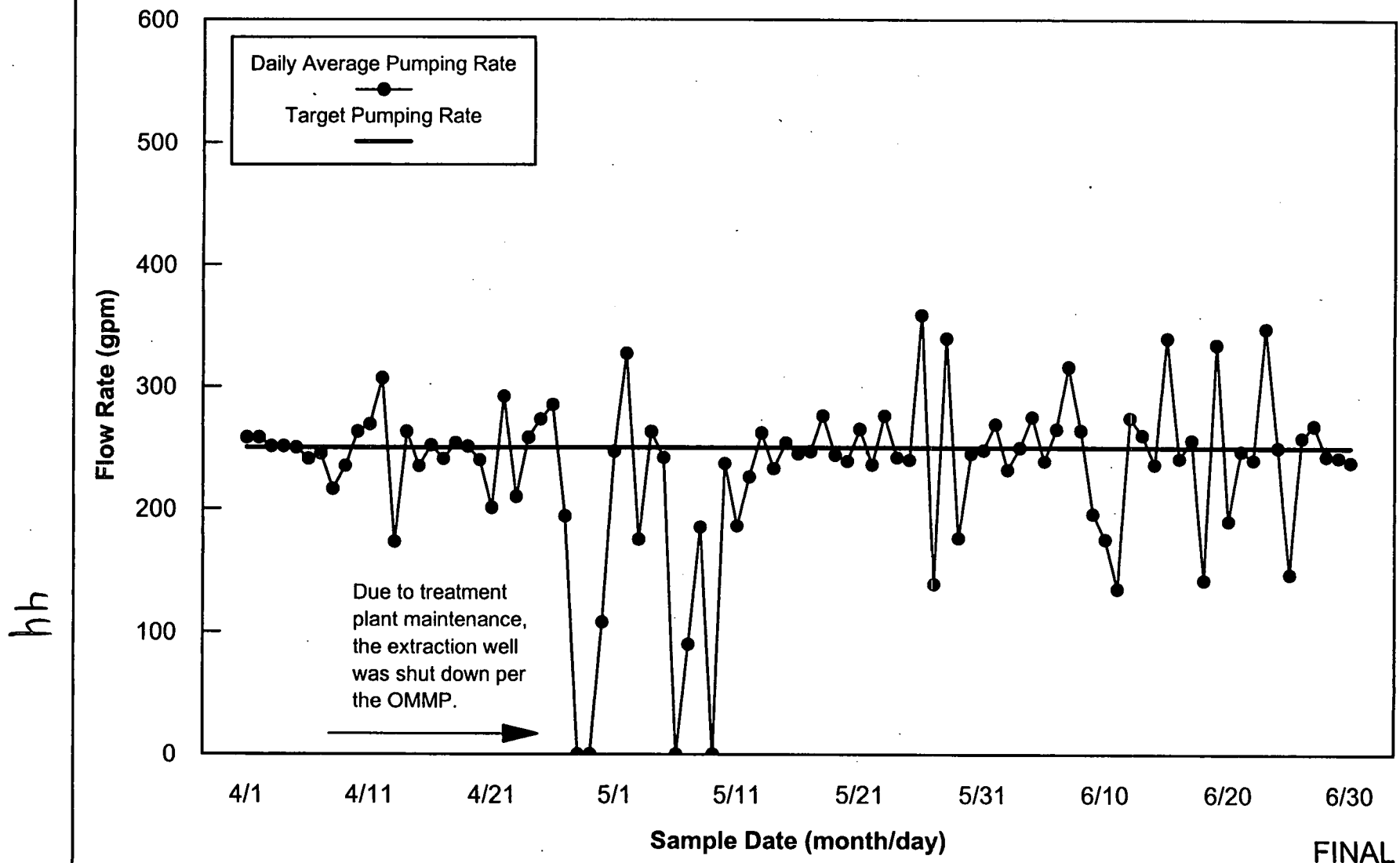


FIGURE 1-19. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME  
EXTRACTION WELL 32308, 4/99 - 6/99

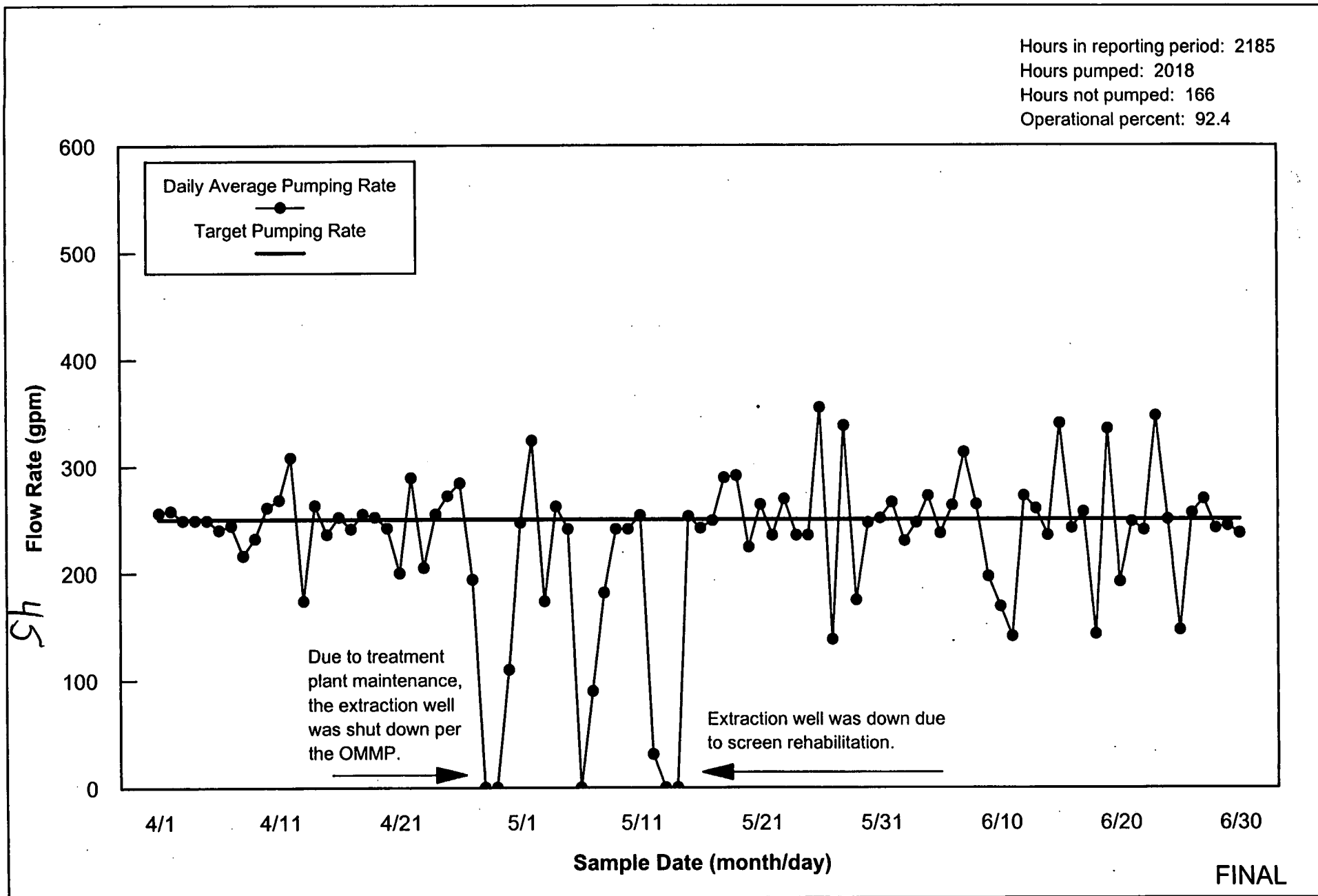
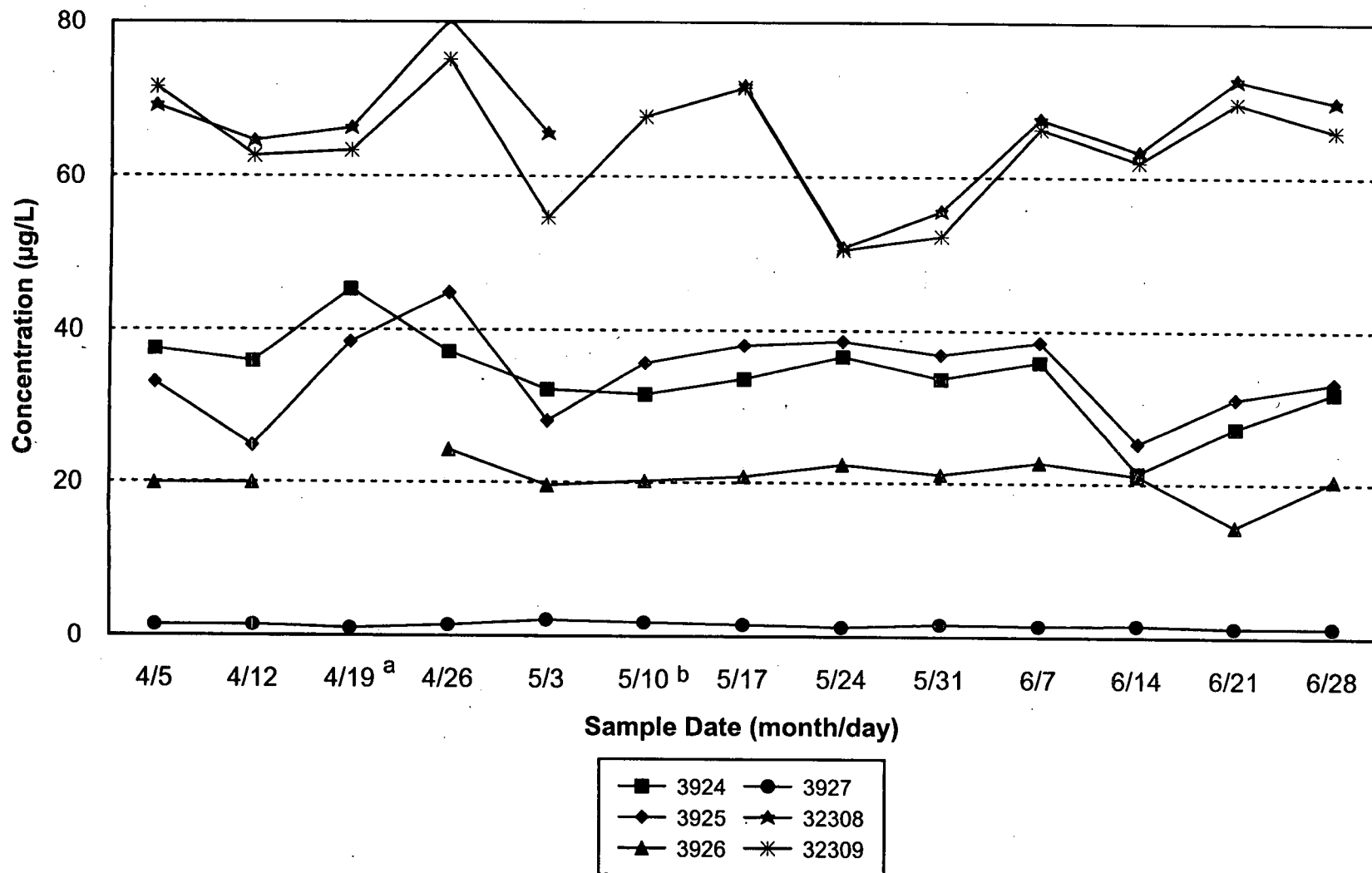


FIGURE 1-20. DAILY AVERAGE PUMPING RATES FOR SOUTH PLUME

EXTRACTION WELL 020000-1/00-0/00

7h



<sup>a</sup> A sample was not collected for Extraction Well 3926.

<sup>b</sup> A sample was not collected for Extraction Well 32308.

FINAL

FIGURE 1-21. WEEKLY TOTAL URANIUM CONCENTRATIONS  
FOR THE SOUTH PLUME MODULE

67

Hours in reporting period: 2184  
 Hours pumped: 1942  
 Hours not pumped: 243  
 Operational percent: 88.9

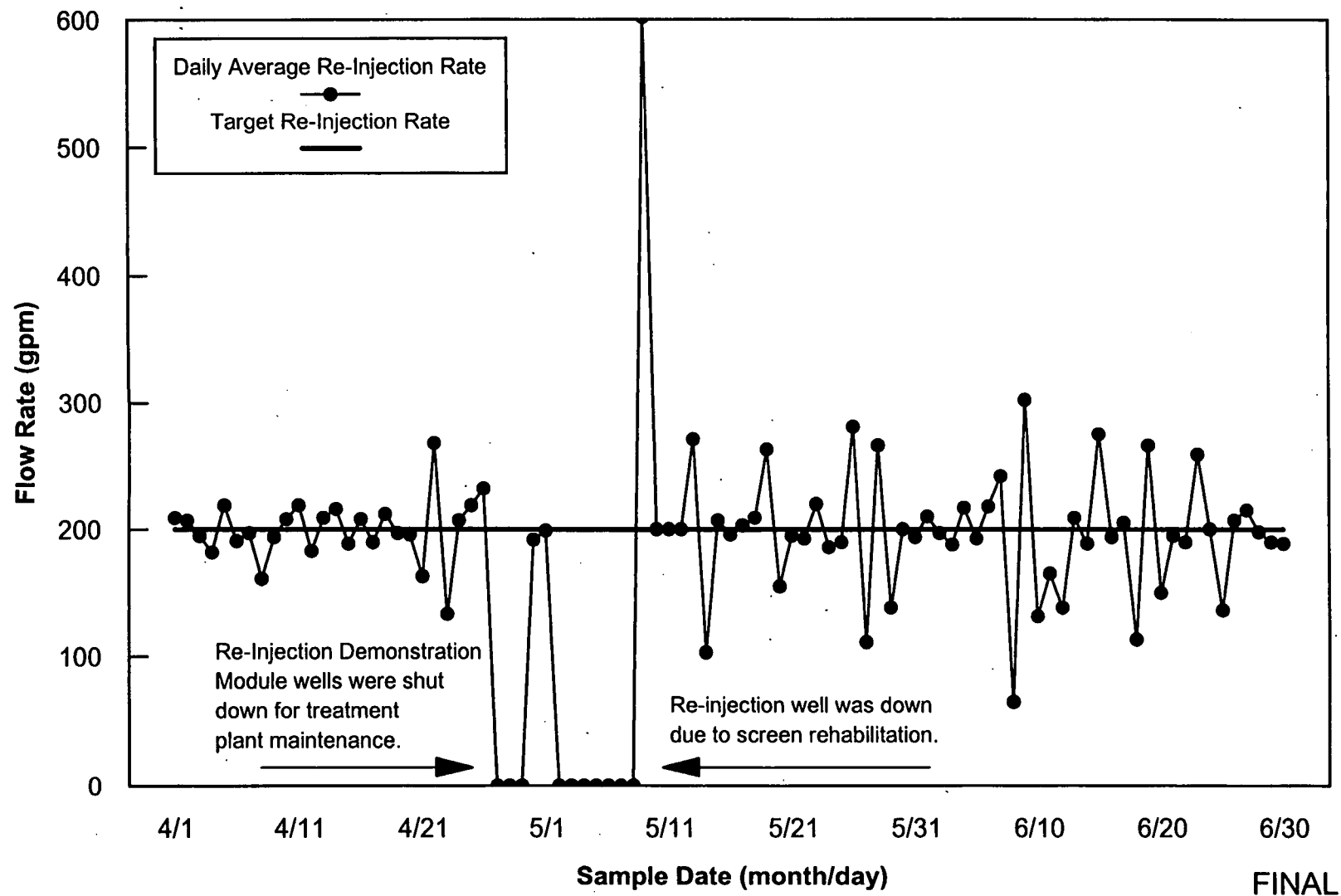
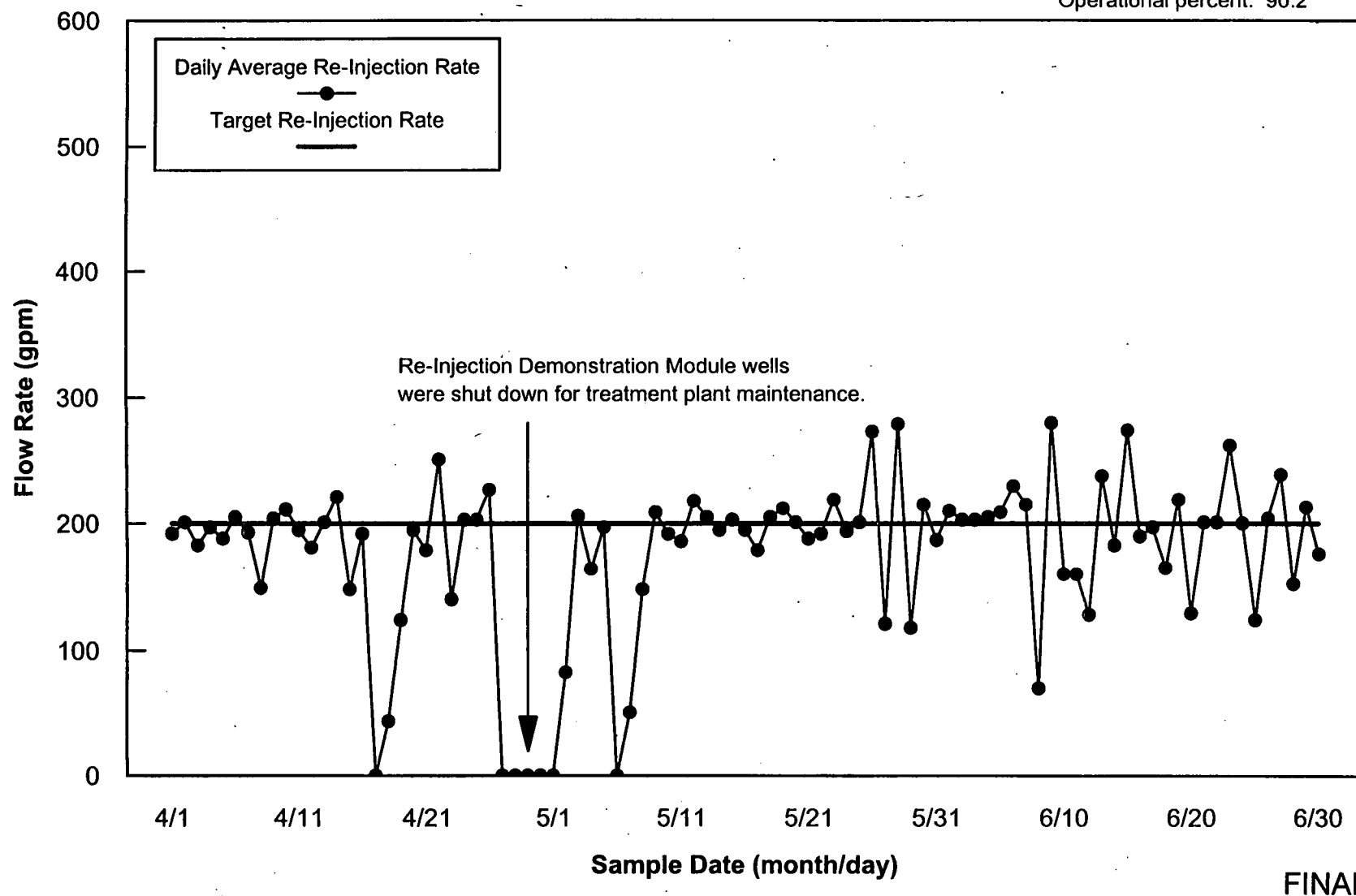


FIGURE 1-22. DAILY AVERAGE RE-INJECTION RATES FOR

Sh

Hours in reporting period: 2183  
 Hours pumped: 1969  
 Hours not pumped: 214  
 Operational percent: 90.2



2521

FIGURE 1-23. DAILY AVERAGE RE-INJECTION RATES FOR  
 RE-INJECTION WELL 22108, 4/99 - 6/99

65

Hours in reporting period: 2183  
 Hours pumped: 1881  
 Hours not pumped: 303  
 Operational percent: 86.1

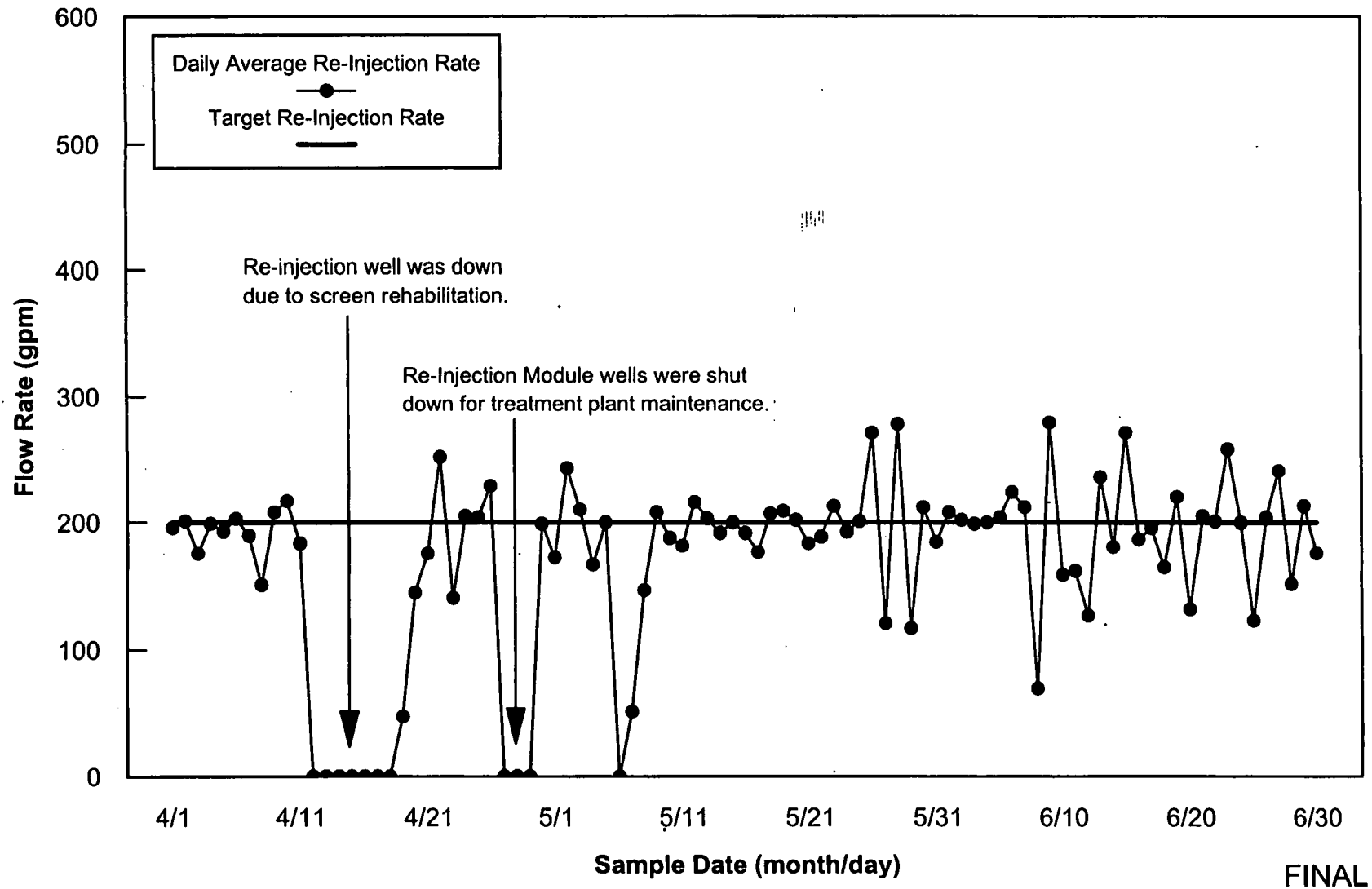
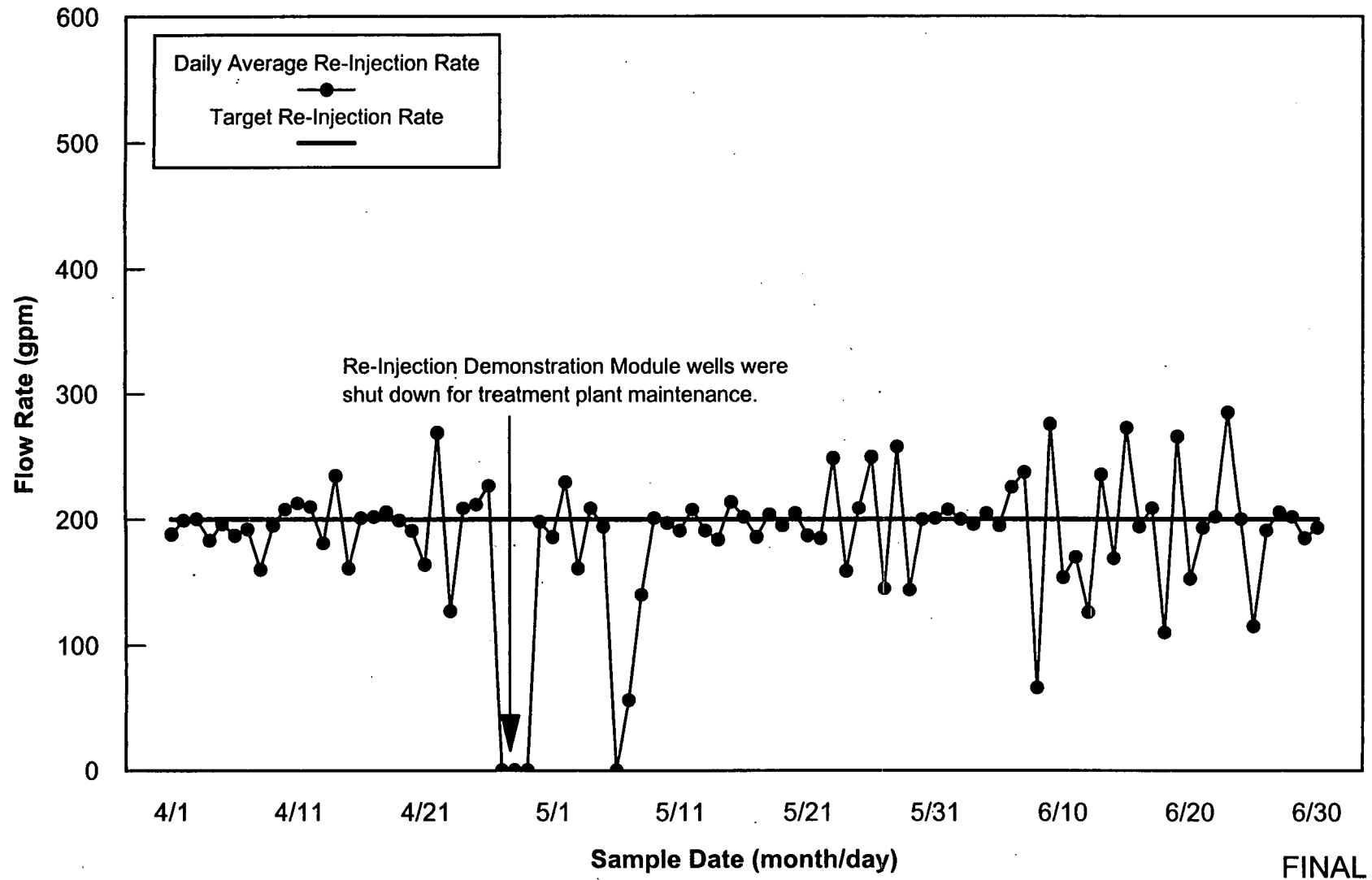


FIGURE 1-24. DAILY AVERAGE RE-INJECTION RATES FOR  
 RE-INJECTION WELL 22109 4/99 - 6/99

05

Hours in reporting period: 2184  
 Hours pumped: 2066  
 Hours not pumped: 118  
 Operational percent: 94.6



-- 2521

FIGURE 1-25. DAILY AVERAGE RE-INJECTION RATES FOR  
 RE-INJECTION WELL 22111, 4/99 - 6/99

15

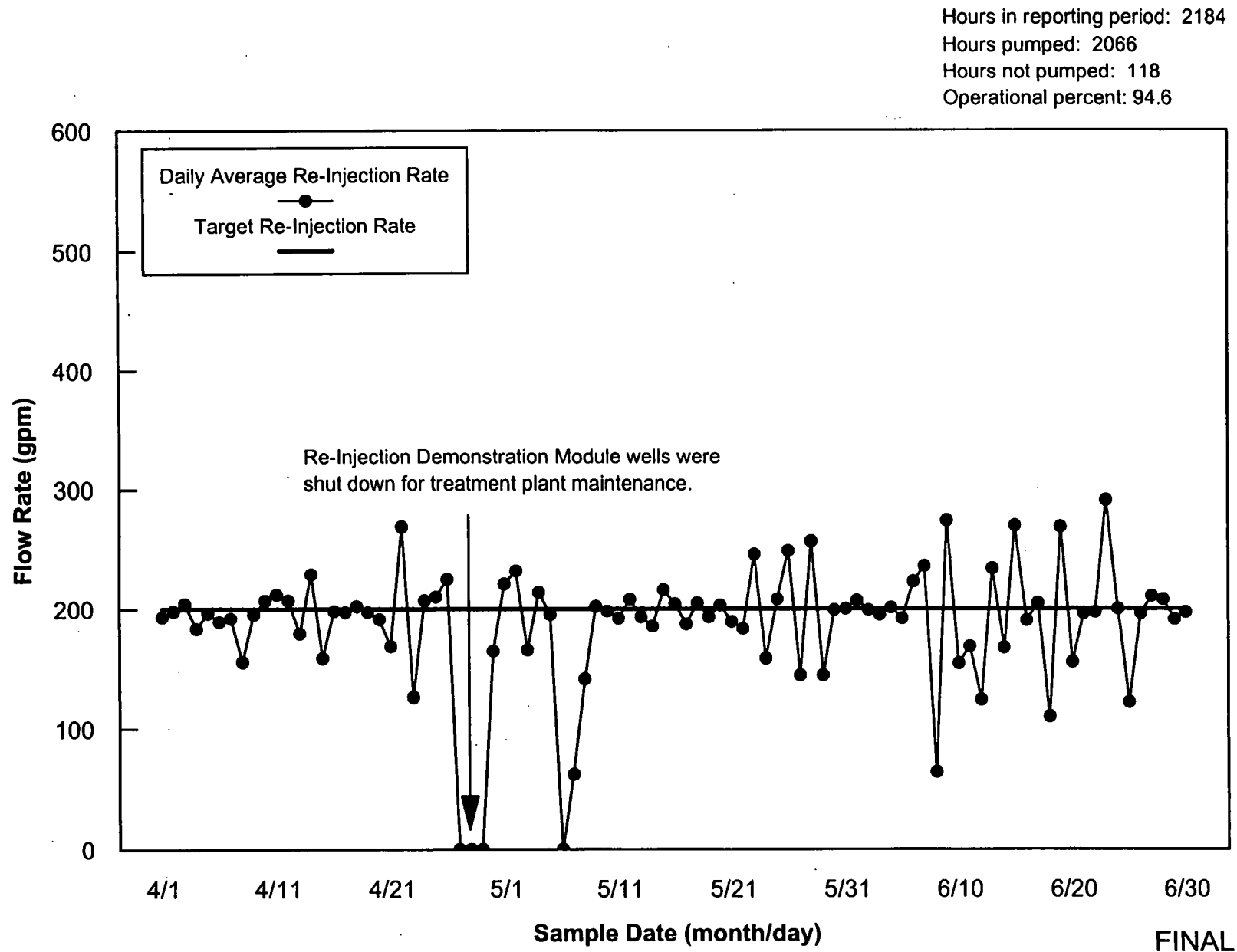


FIGURE 1-26. DAILY AVERAGE RE-INJECTION RATES FOR

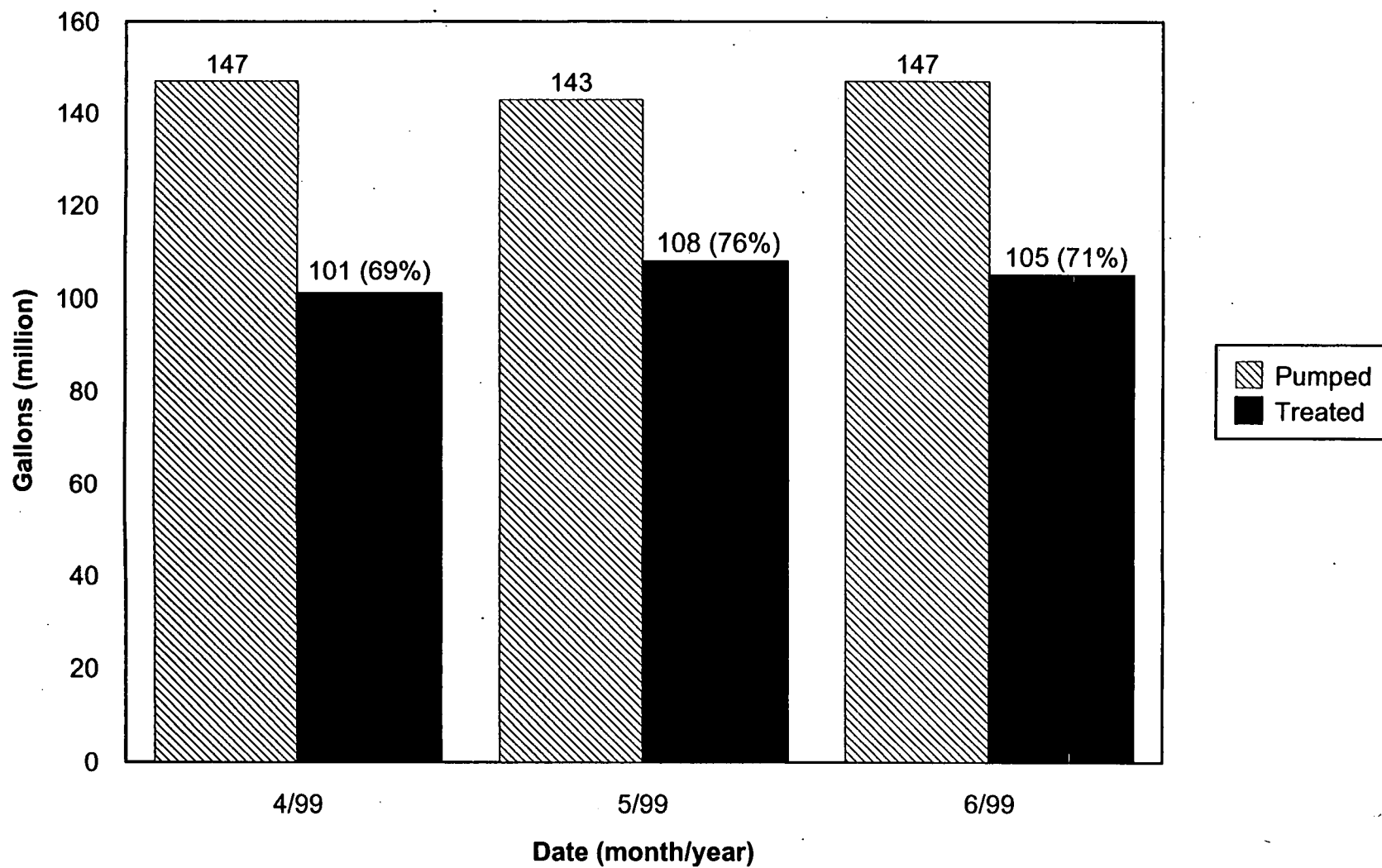
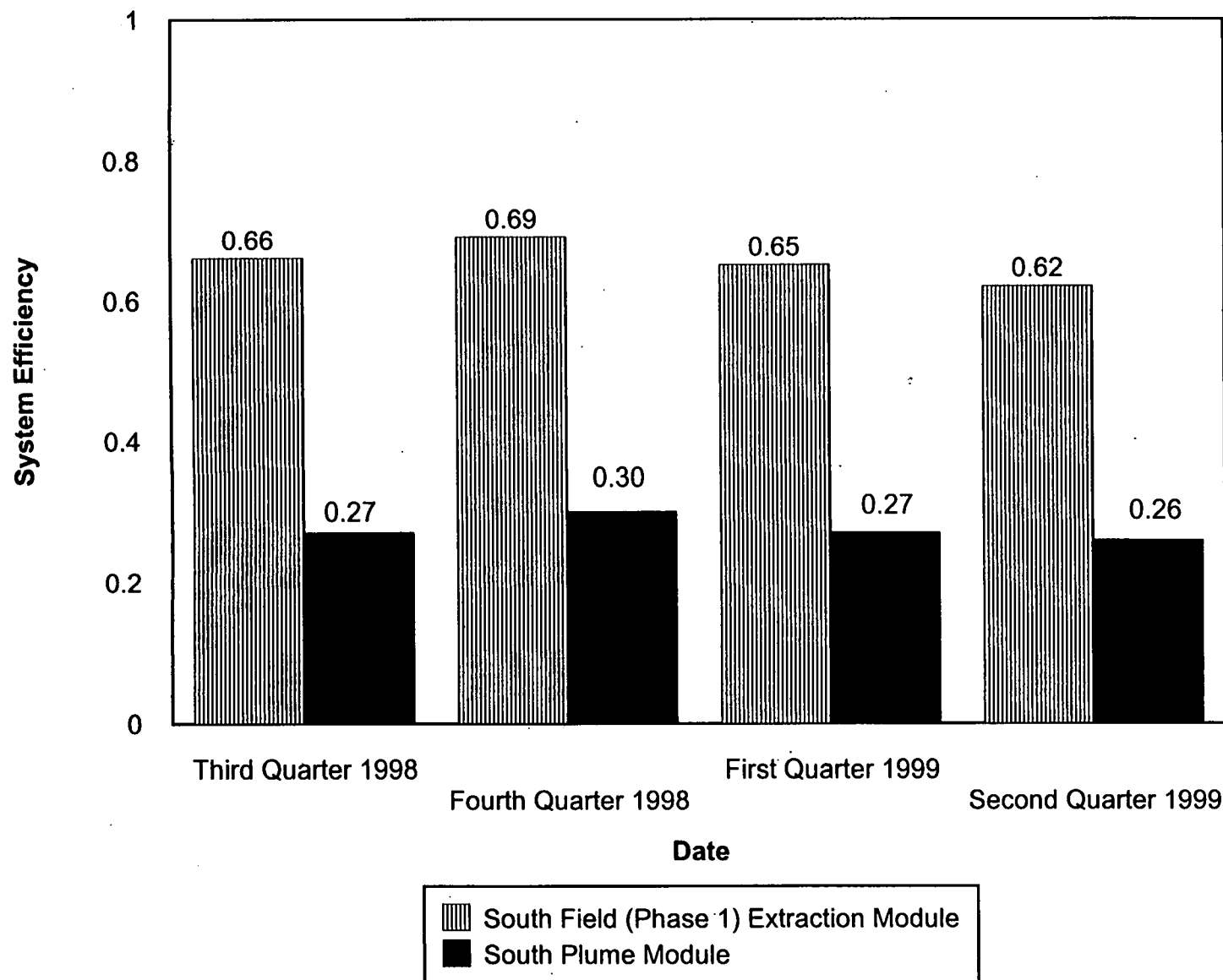


FIGURE 1-27. TOTAL GROUNDWATER PUMPED VS.  
GROUNDWATER TREATED FOR SECOND QUARTER 1999

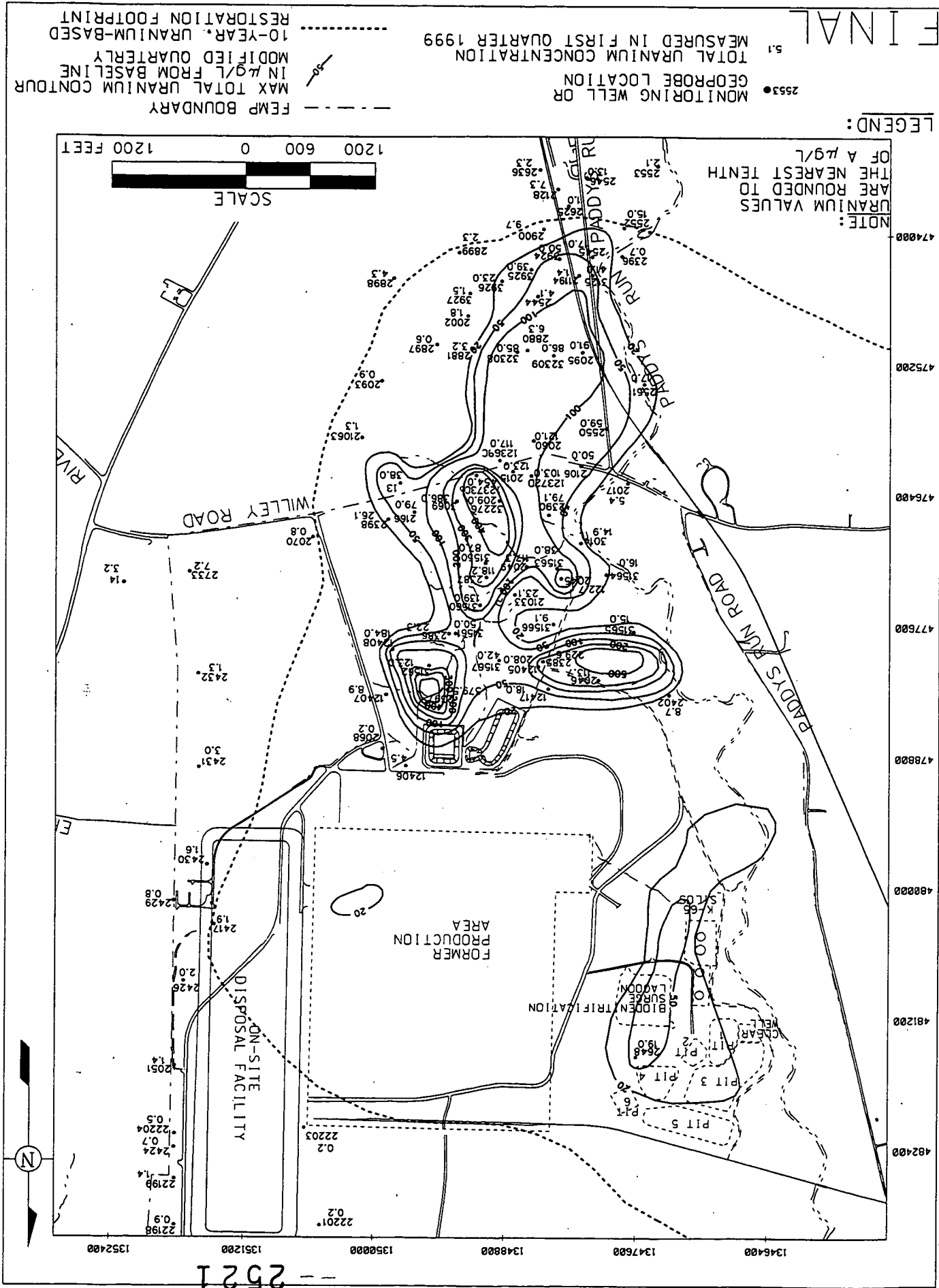
53

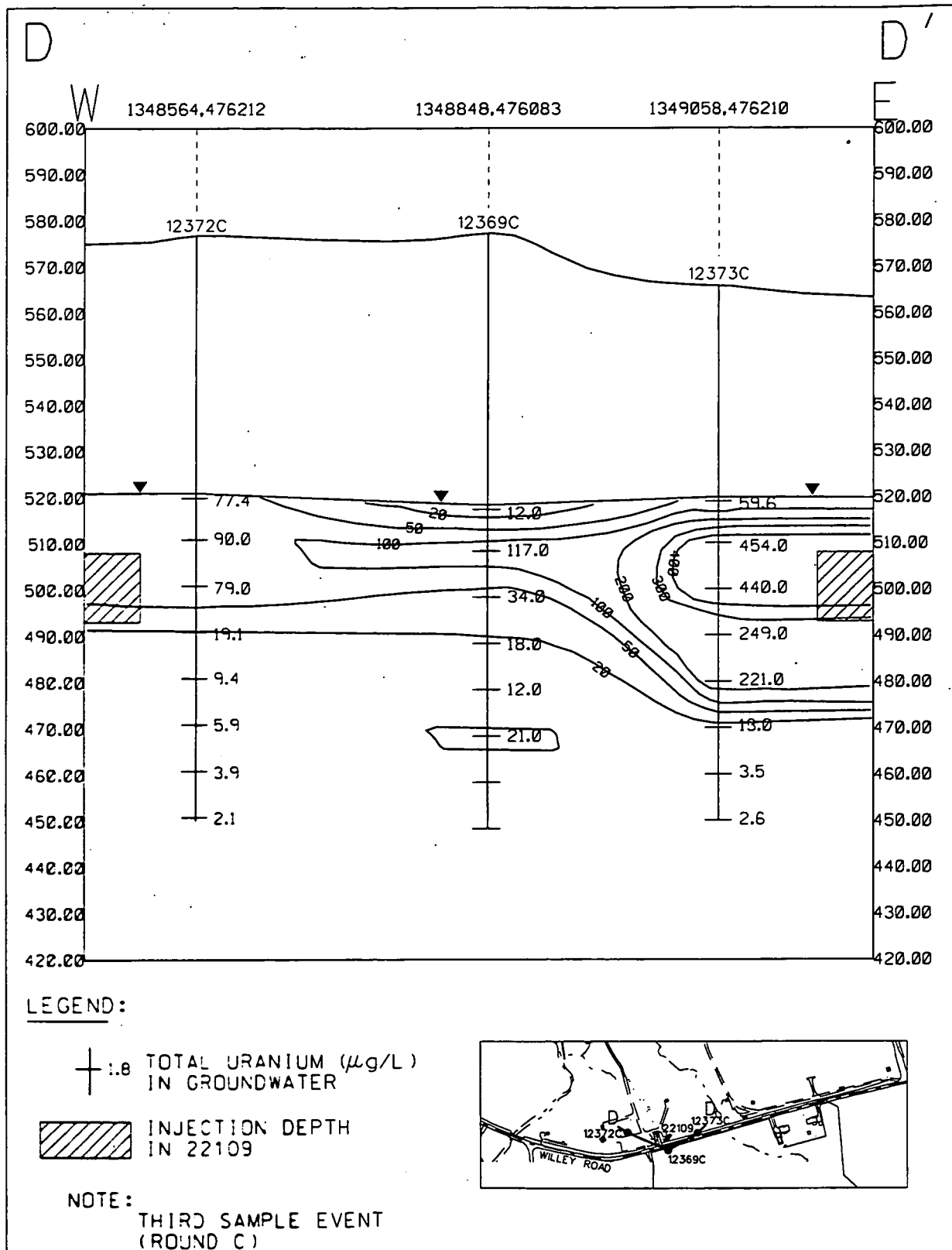


FINAL

FIGURE 1-28. SOUTH FIELD (PHASE 1) EXTRACTION AND SOUTH PLUME MODULES' EFFICIENCIES (LBS OF URANIUM REMOVED/MILLION GALLONS PUMPED)

FIGURE 1-29. TOTAL URANIUM PLUME MAP, FIRST QUARTER 1999





FINAL

FIGURE 1-30. CROSS SECTION D-D', GEOPROBE RESULTS FOR TOTAL URANIUM IN GROUNDWATER, DECEMBER 1998 TO JANUARY 1999

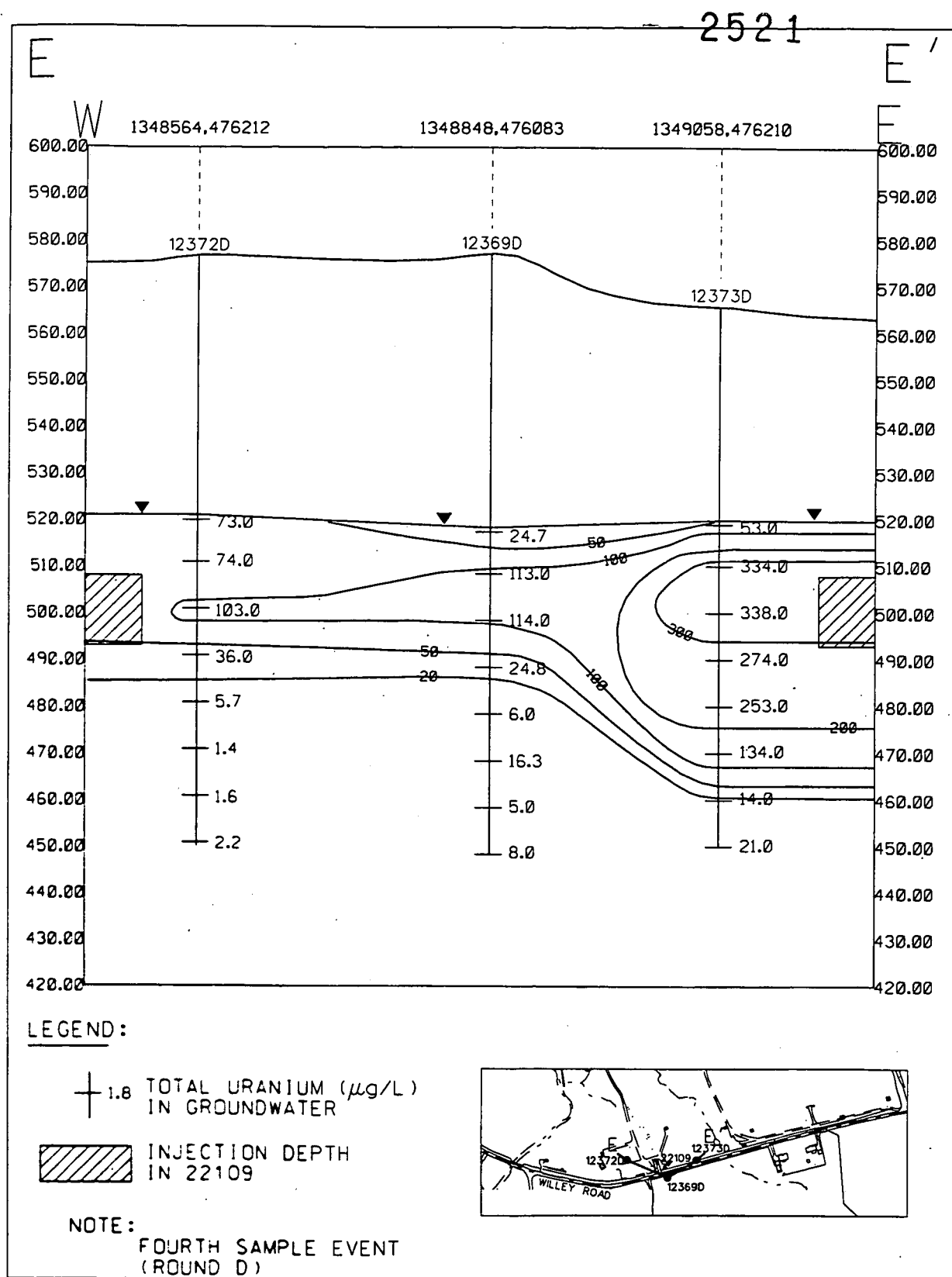
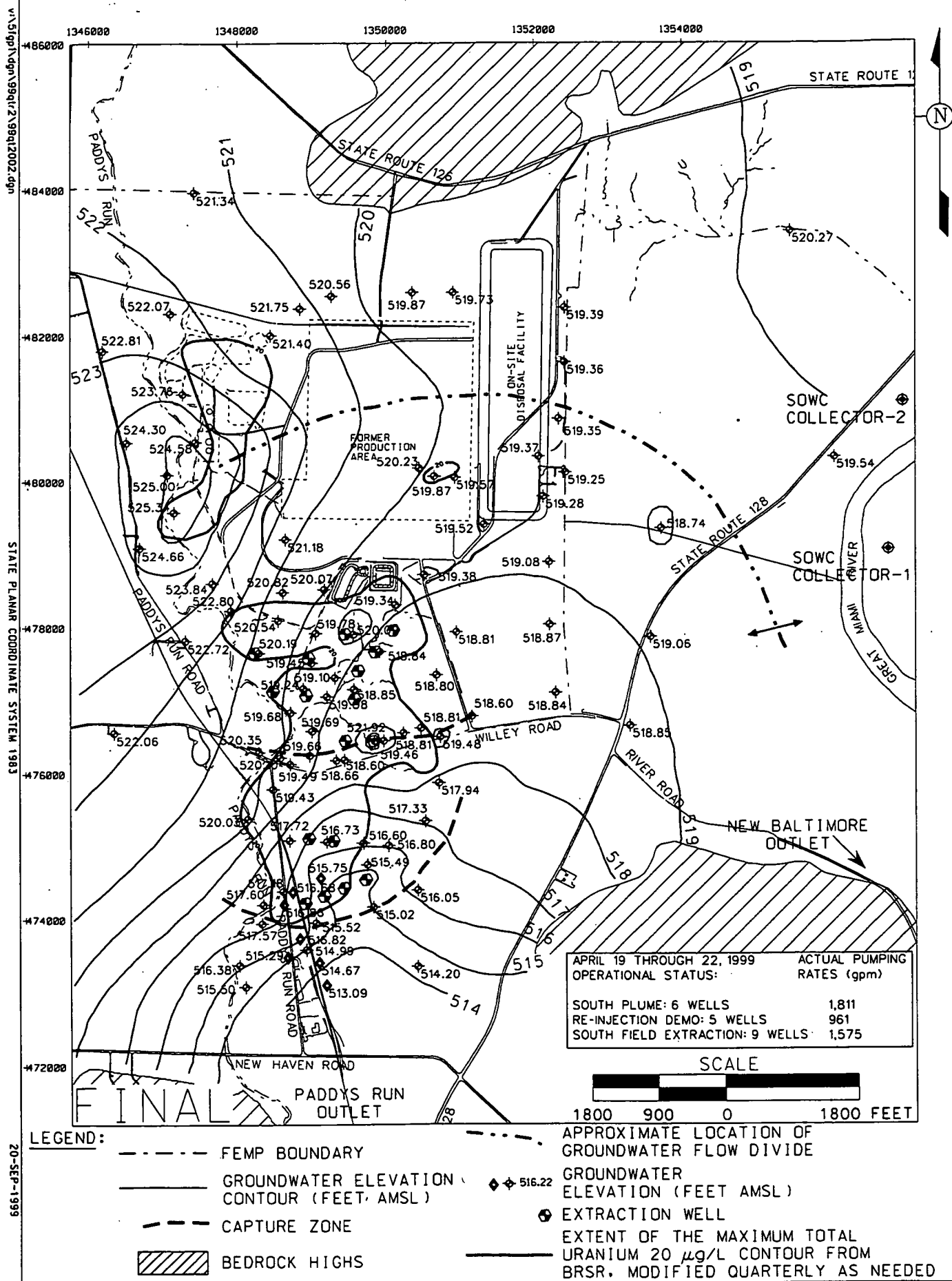
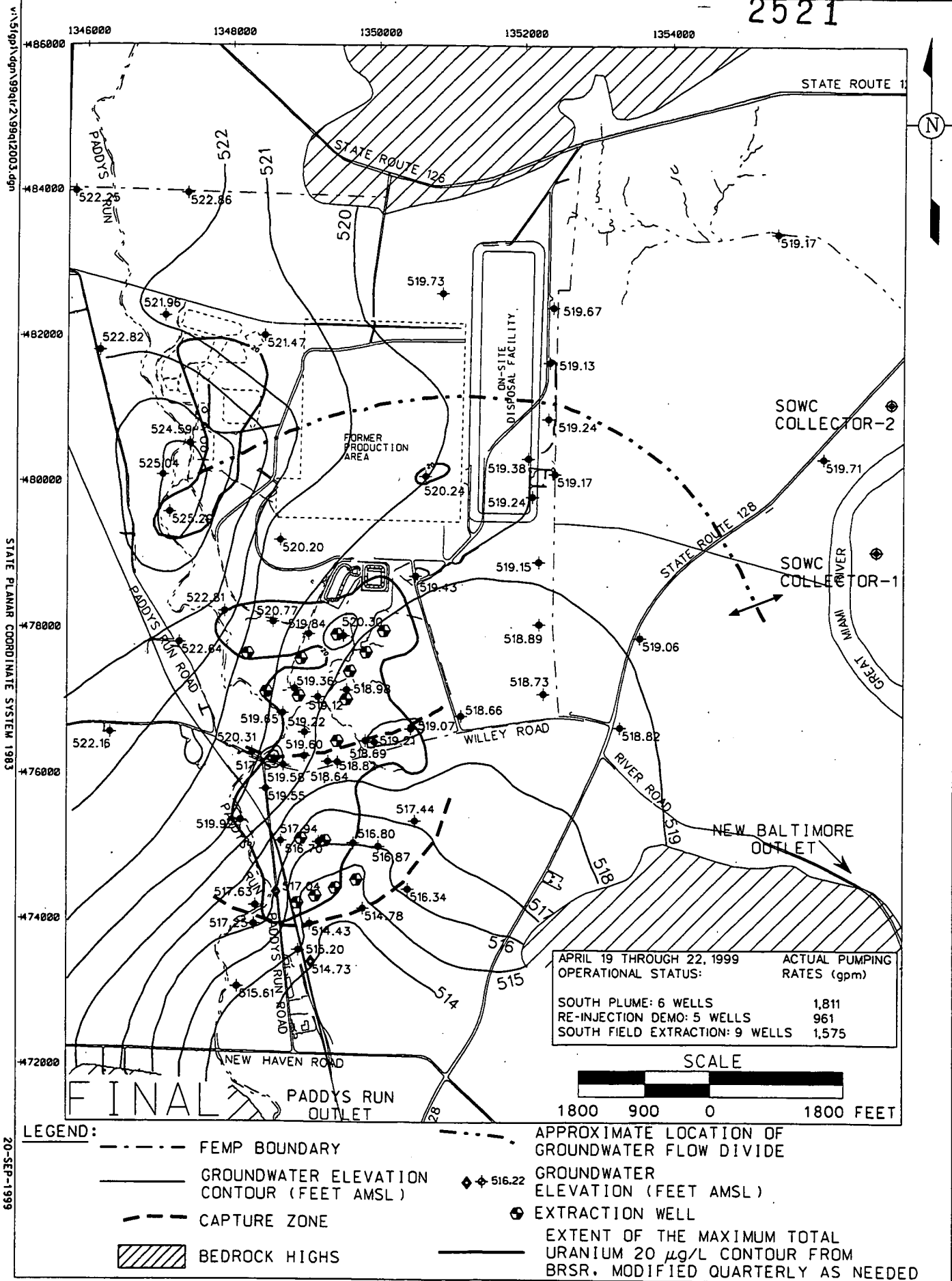


FIGURE 1-31. CROSS SECTION E-E', GEOPROBE RESULTS FOR TOTAL URANIUM IN GROUNDWATER, MARCH 1999





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STATE PLANNED COORDINATE SYSTEM 1983

20-SEP-1999

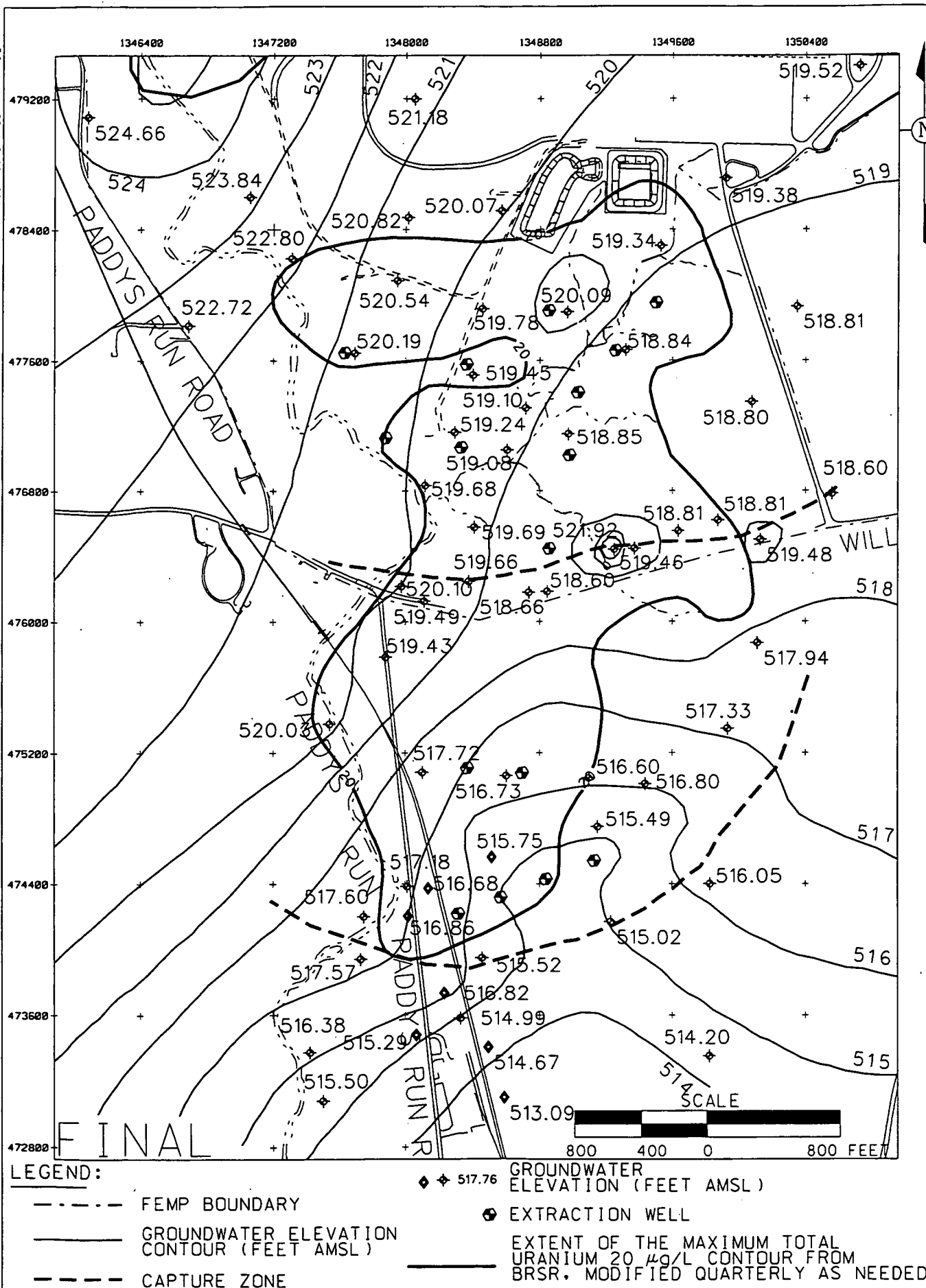


FIGURE 1-34. DETAILED GROUNDWATER ELEVATIONS FOR TYPE 2 MONITORING WELLS, APRIL 1999

59

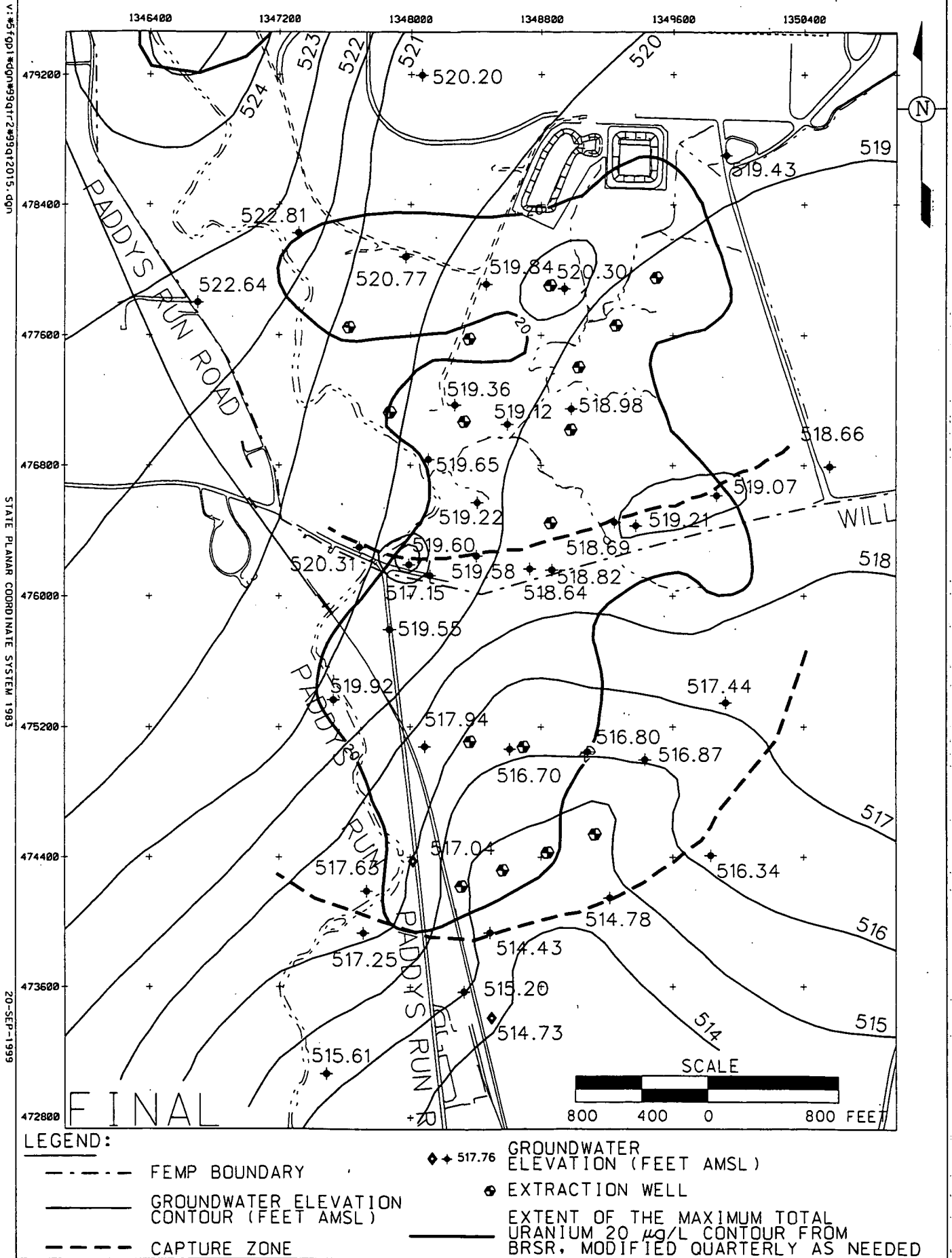
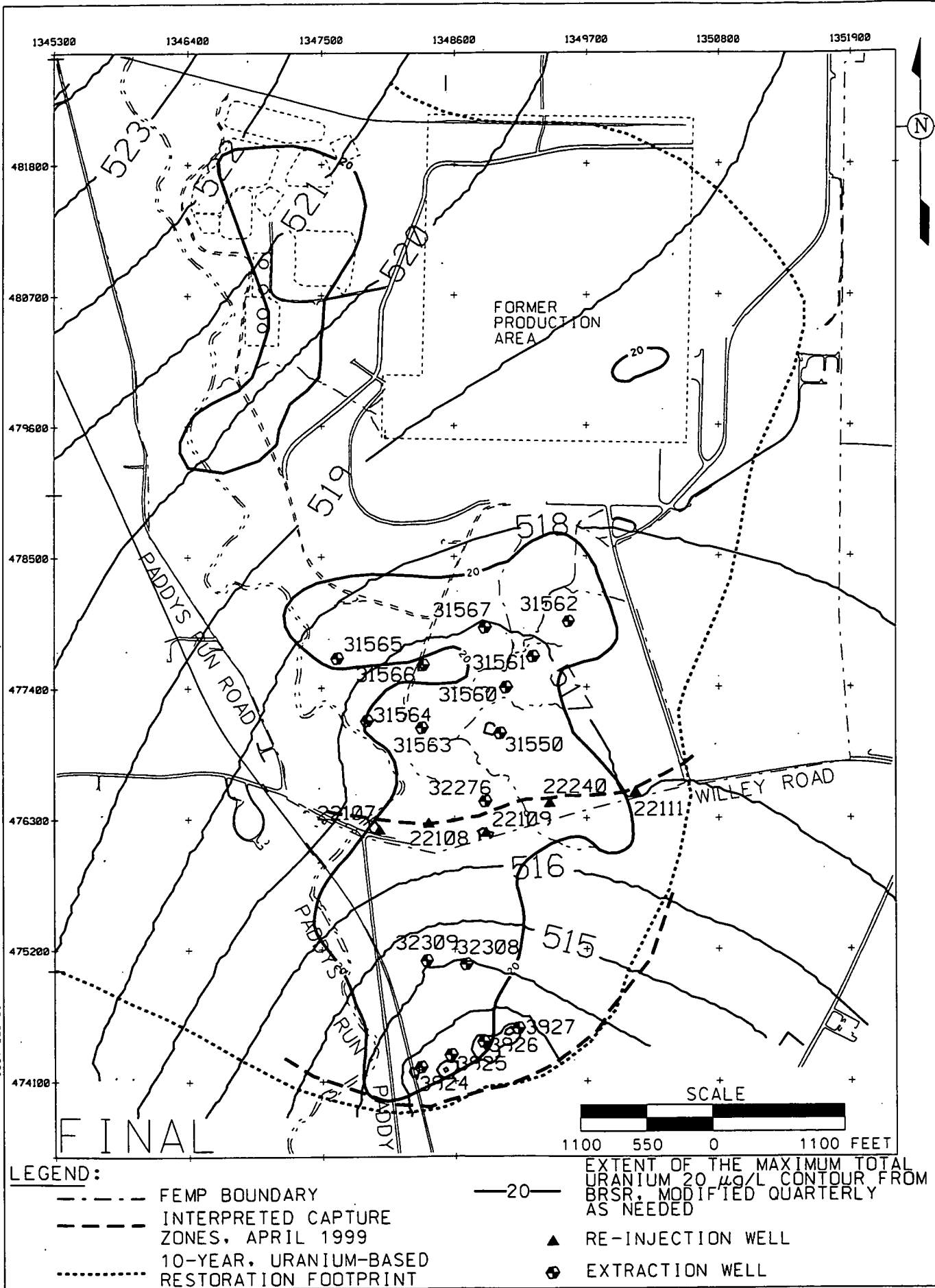


FIGURE 1-35. DETAILED GROUNDWATER ELEVATIONS FOR TYPE 3 WELLS, APRIL 1999

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STATE PLANAR COORDINATE SYSTEM 1983

23-SEP-1999



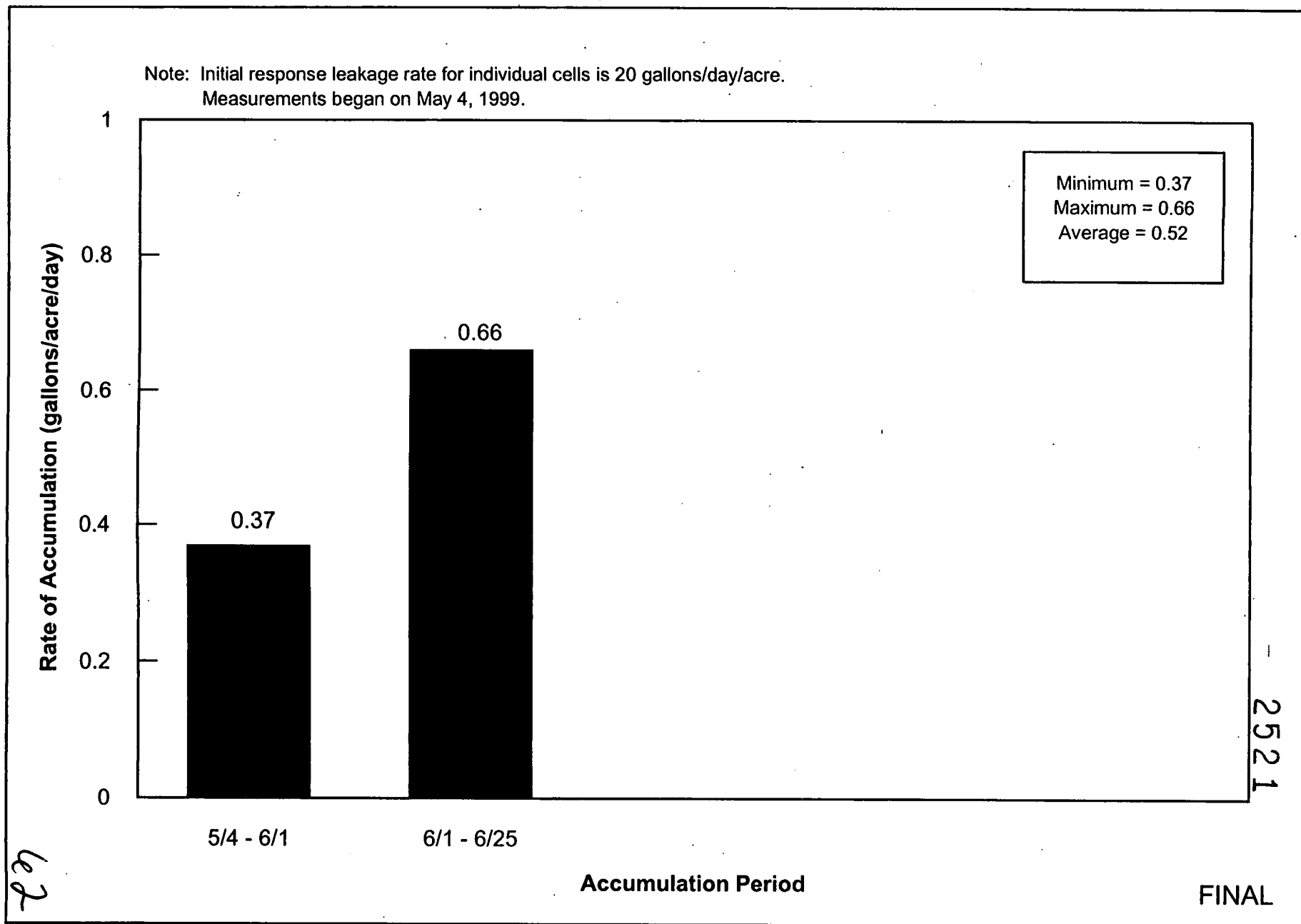


FIGURE 1-37. ON-SITE DISPOSAL FACILITY CELL 1 LEAK DETECTION SYSTEM  
RATE OF ACCUMULATION (GALLONS/ACRE/DAY), MAY 4, 1999 THROUGH JUNE 25, 1999

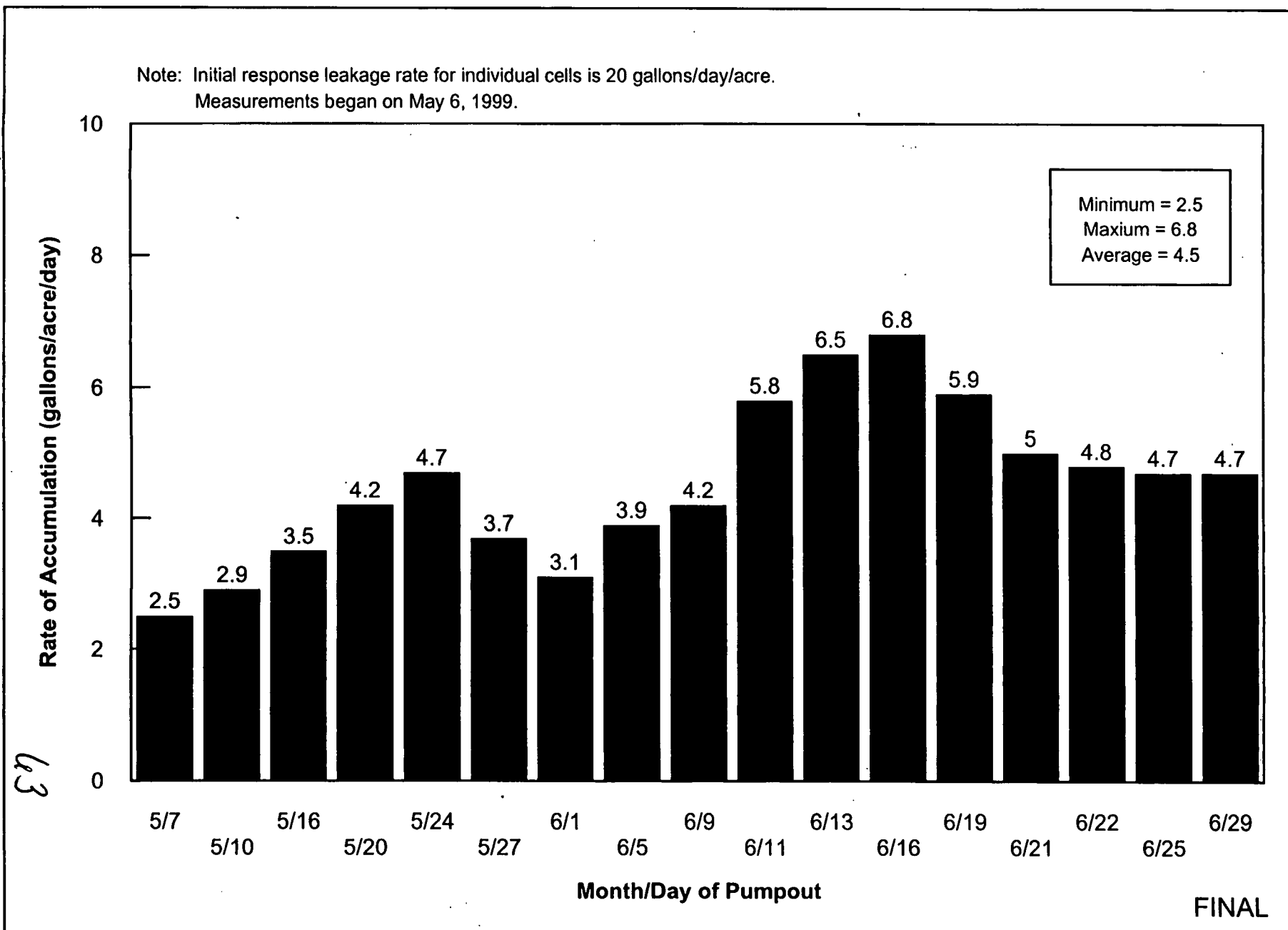


FIGURE 1-38. ON-SITE DISPOSAL FACILITY CELL 2 LEAK DETECTION SYSTEM  
RATE OF ACCUMULATION (GALLONS/ACRE/DAY) MAY 6, 1999 THROUGH JUNE 29, 1999

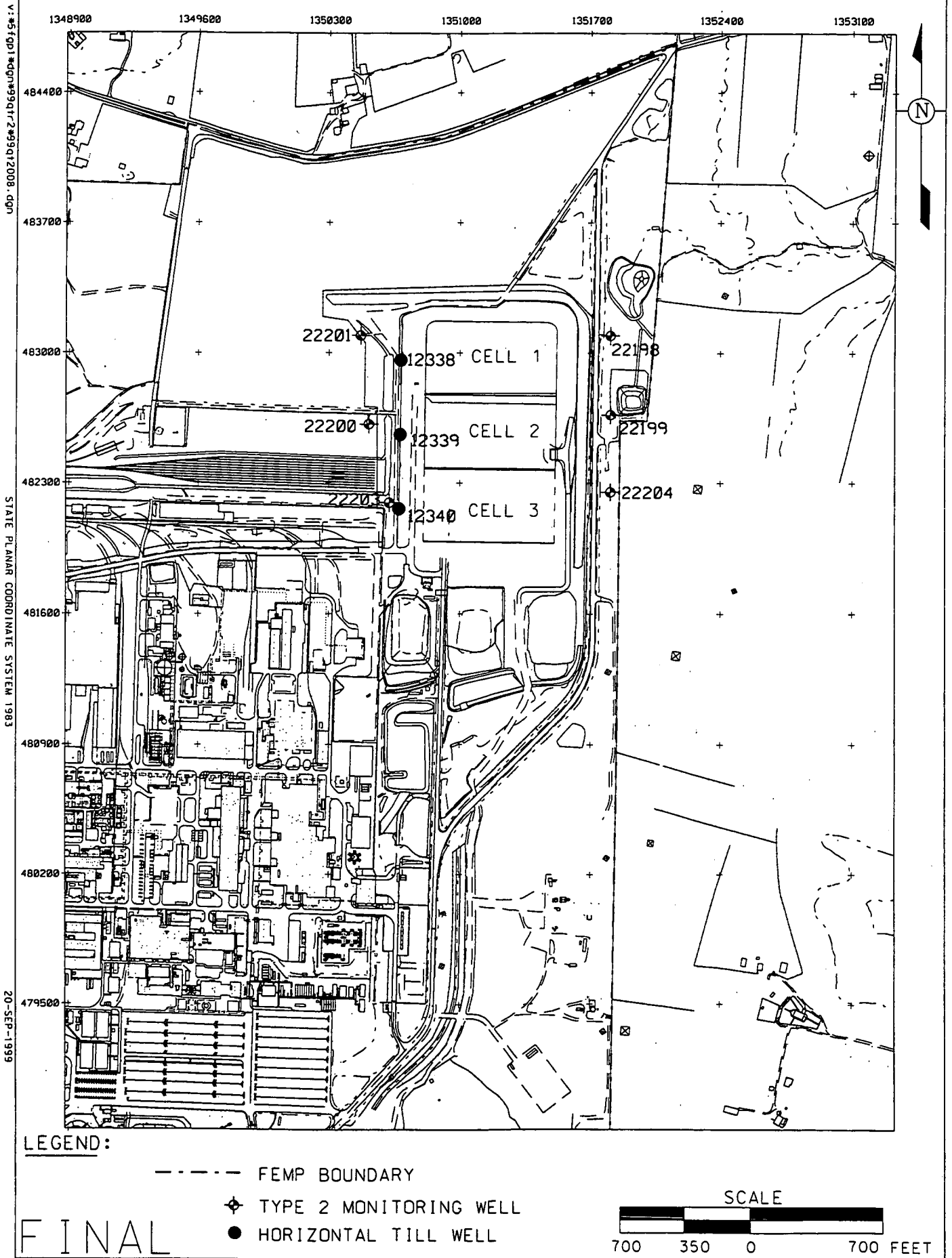


FIGURE 1-39. ON-SITE DISPOSAL FACILITY WELL LOCATIONS

64

FIGURE 1-40

GROUNDWATER SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

**SAMPLING ACTIVITIES**

South Plume Module:  
Operational  
Aquifer Conditions

South Field Extraction Module:  
Operational (Phase 1)  
Aquifer Conditions

Re-Injection Demonstration Module<sup>a</sup>:  
Operational

Waste Storage Area Module:  
Aquifer Conditions

Plant 6 Area Module:  
Aquifer Conditions

Routine Water-Level/Flow Direction Monitoring

RCRA Property Boundary Monitoring

Private Well Monitoring

KC-2 Warehouse Monitoring

OSDF Groundwater Monitoring:

Cell 1

Cell 2

Cell 3

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
				◆		◆	◆	◆			
					◆	◆	◆	◆			
						◆	◆	◆			
					◆						
					◆						
						◆					
			◆								
			◆								
				◆							
				◆							
			◆	◆	◆						

◆ Data summarized/evaluated  
in the next report

FINAL

<sup>a</sup>Aquifer conditions for this module are monitored under the South Plume Module, South Field Module, RCRA Property Boundary Program, and Geoprobe® sampling results.

## 2.0 SURFACE WATER AND TREATED EFFLUENT UPDATE

### 2.1 INTRODUCTION

This section provides a status of the surface water and treated effluent monitoring for the second quarter of 1999. Figure 2-1 shows the data included in this section. Figure 2-2 identifies the surface water and treated effluent sample locations. Analytical results from the following routine monitoring program elements were utilized to complete the reporting requirements identified in Section 4.6.2 of the IEMP:

- National Pollutant Discharge Elimination System (NPDES) permit (data obtained from April through June 1999)
- Federal Facilities Compliance Agreement (FFCA) requirements (data obtained from April through June 1999)
- IEMP Characterization Program results (data obtained from January through March 1999).

### 2.2 FINDINGS

The principal findings from the reporting period are summarized below:

#### NPDES Permit Compliance

- Wastewater and storm water discharges from the FEMP were in compliance more than 99 percent of the time during the second quarter of 1999. Two NPDES noncompliances occurred during the second quarter at an internal monitoring point at the sewage treatment plant (STP 4601). One daily maximum noncompliance and a monthly average noncompliance for total suspended solids occurred in April. These were related to difficulties in controlling total suspended solids in the sewage treatment process. Neither of these permit noncompliances caused an exceedance at the Parshall Flume (PF 4001), which is the final effluent sample location prior to discharge into the Great Miami River. Therefore, none of these noncompliances had an adverse impact on the final discharge to the Great Miami River. The ongoing evaluation and appropriate actions to alleviate these total suspended solids exceedances are identified in the noncompliance reports which are sent to OEPA as required by the NPDES permit.

- The following activities occurred during the second quarter of 1999 which could have potentially impacted the water quality at various surface water sample locations (identified in parentheses):
  - Excavation, screening, and hauling activities in the on-site disposal facility borrow area (SWD-02 and STRM 4003)
  - Location and repair of leaks associated with the on-site disposal facility leachate conveyance system (SWD-02 and STRM 4003)
  - Construction activities associated with on-site disposal facility Cell 3 (SWD-02 and STRM 4003)
  - Hauling and placement of waste material into on-site disposal facility Cell 2, including the construction of an access ramp on the east side of Cell 2 (SWD-02, STRM 4003, and PF 4001)
  - Completion of construction activities associated with Area 1, Phase II site preparation (SWD-02 and STRM 4003)
  - Excavation activities in the old sewage treatment plant area within Area 1, Phase II (SWD-02, STRM 4003, and PF 4001)
  - Construction activities associated with the wetland mitigation efforts in Area 1, Phase I (STRM 4003 and SWD-01)
  - Loading and shipping of five train-loads of contaminated soil in support of Waste Pits Remedial Action Project (WPRAP) activities (STRM 4005 and PF 4001)
  - Construction activities associated with the WPRAP (PF 4001 and STRM 4006)
  - Railyard activities in support of the loading and shipping of trains (STRM 4006)
  - Construction activities associated with the roads and electrical upgrades portion of the Silos Infrastructure Project (STRM 4005)

Review of the surface water and treated effluent data provided with this report does not indicate that these activities have caused any significant FRL or benchmark toxicity value (BTV) exceedances (identified in surveillance subsection). However, data will continue to be evaluated in light of ongoing remediation activities to assess impacts to the surface water pathway.

#### FFCA and Operable Unit 5 Record of Decision Compliance

- Figure 2-3 shows that a cumulative total of 137 pounds of uranium were discharged to the Great Miami River in effluent from January through June 1999. The Record of

Decision for Remedial Actions at Operable Unit 5 (DOE 1996) established an annual discharge limit to the Great Miami River of 600 pounds for total uranium.

- Uncontrolled runoff also contributes to the amount of total uranium entering the environment. An estimated 6.25 pounds of total uranium are discharged to Paddys Run through uncontrolled runoff with every inch of rain. The 6.25 value was determined during the remedial investigation and prior to the initiation of remediation activities, and may result in conservative estimates of uranium mass in uncontrolled runoff. Figure 2-4 shows that precipitation during the second quarter of 1999 was 10.21 inches; therefore, the mass of total uranium discharged to Paddys Run through uncontrolled runoff from April through June 1999 is estimated to be 63.81 pounds.
- DOE is continuing to re-evaluate the estimated 6.25 pounds of uranium that is discharged to the environment through uncontrolled runoff with every inch of rain. This evaluation will be based on the current drainage patterns and more recent analytical data collected at the discharge points into Paddys Run. The actual amount of uranium released through uncontrolled runoff is thought to be significantly less as a result of the removal of sources and the additional measures that have been taken to control contaminated runoff over the last several years.
- Figure 2-5 illustrates that the monthly average total uranium concentration limit of 20  $\mu\text{g/L}$  for water discharged to the Great Miami River was met each month during the second quarter of 1999. There were no changes to Table 2-1 because no treatment plant maintenance or significant precipitation bypass events occurred during the second quarter.
- Figure 2-6 presents controlled and uncontrolled surface water flow areas for the second quarter of 1999. As identified in previous IEMP quarterly status reports, an evaluation of controlled areas is to occur at least quarterly in order to help ensure that the appropriate areas are being controlled.

### Surveillance Monitoring

- There were no FRL or BTV exceedances at any monitored location. Therefore, there were no FRL or BTV exceedances attributable to the FEMP in the Great Miami River.
- There were no exceedances of the 530  $\mu\text{g/L}$  surface water total uranium FRL. As Figure 2-7 shows, the results from the property boundary at Paddys Run (SWP-03) indicate that total uranium concentrations in surface water leaving the site are consistently below both the surface water FRL and the groundwater FRL.
- Sample location STRM 4004 was the only dry location during the second quarter of 1999. Therefore, the quarterly total uranium sample and the semiannual NPDES samples from this location were not collected.

Figure 2-8 shows the data from the surface water and treated effluent sampling activities that will be included in the next IEMP quarterly status report. The next quarterly status report will be submitted in

December 1999. The report will contain NPDES and FFCA data from July through September 1999 (third quarter) and the results of the analytical data from the IEMP Characterization Program from April through June 1999 (second quarter).

TABLE 2-1

1999 TREATMENT BYPASS EVENTS

Event	Duration (hours)	Number of Bypass Days <sup>a</sup>	Cumulative Number of Bypass Days	Total Uranium Discharged (pounds)  (to Great Miami River)	Total Water Discharged (millions of gallons)  (to Great Miami River)
<b>Treatment Plant Maintenance Bypasses</b>					
March 15 through March 17	72	3	3	3.29	13.767

<sup>a</sup>Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project (DOE 1997c).

FIGURE 2-1

SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

SAMPLING ACTIVITIES

NPDES

FFCA

IEMP Characterization

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
			◆	◆	◆						
			◆	◆	◆						
◆	◆	◆									

◆ Data summarized/  
evaluated in this report

FINAL

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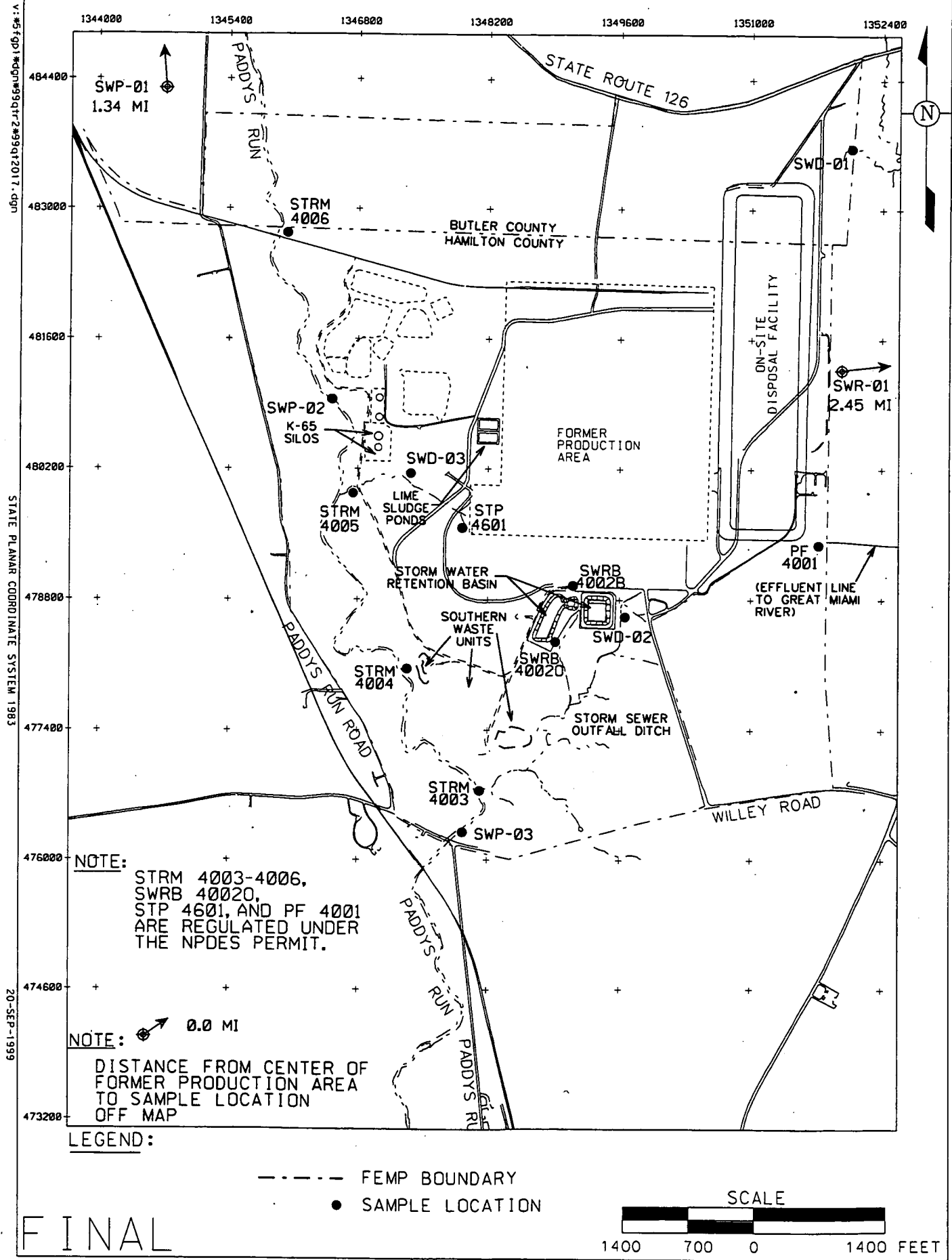
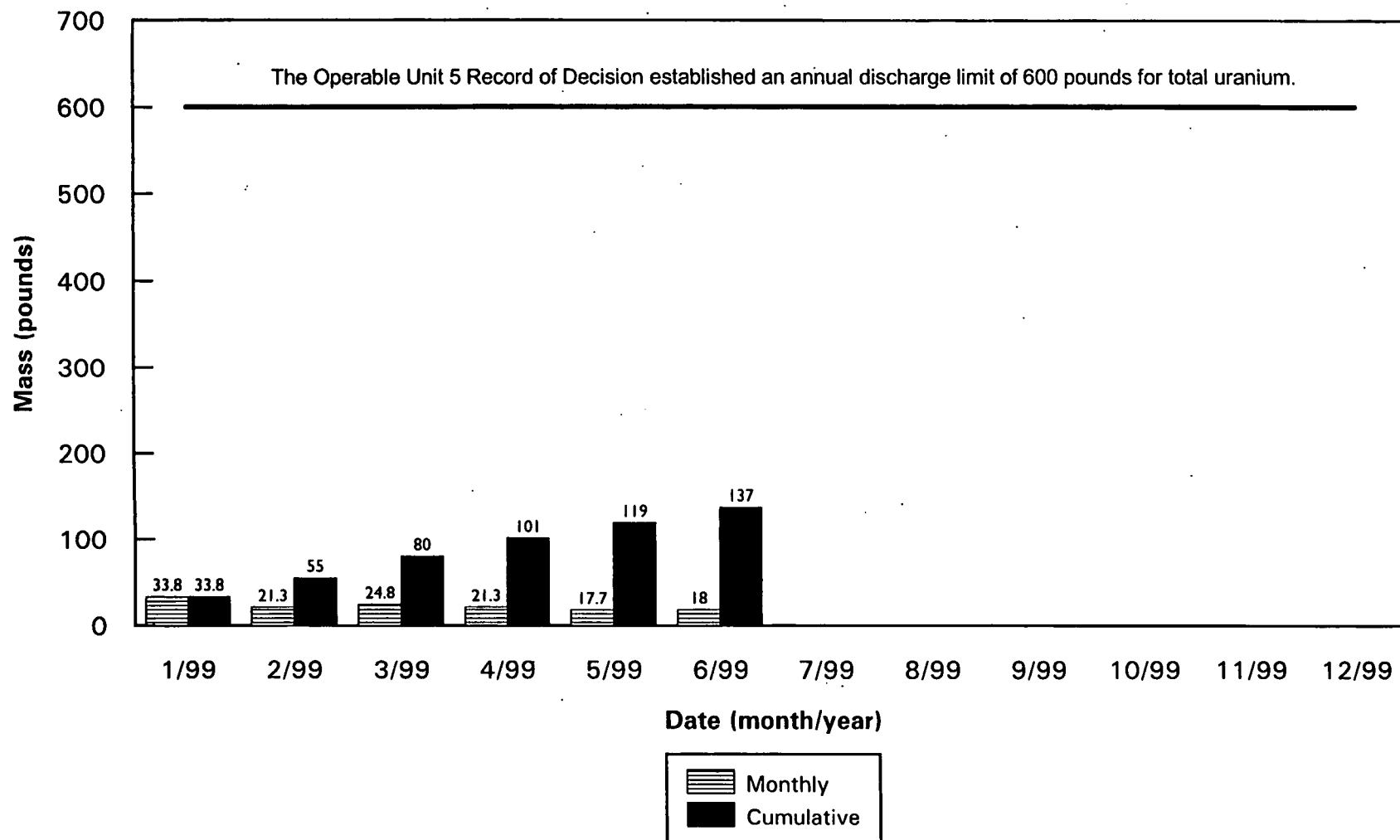


FIGURE 2-2. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

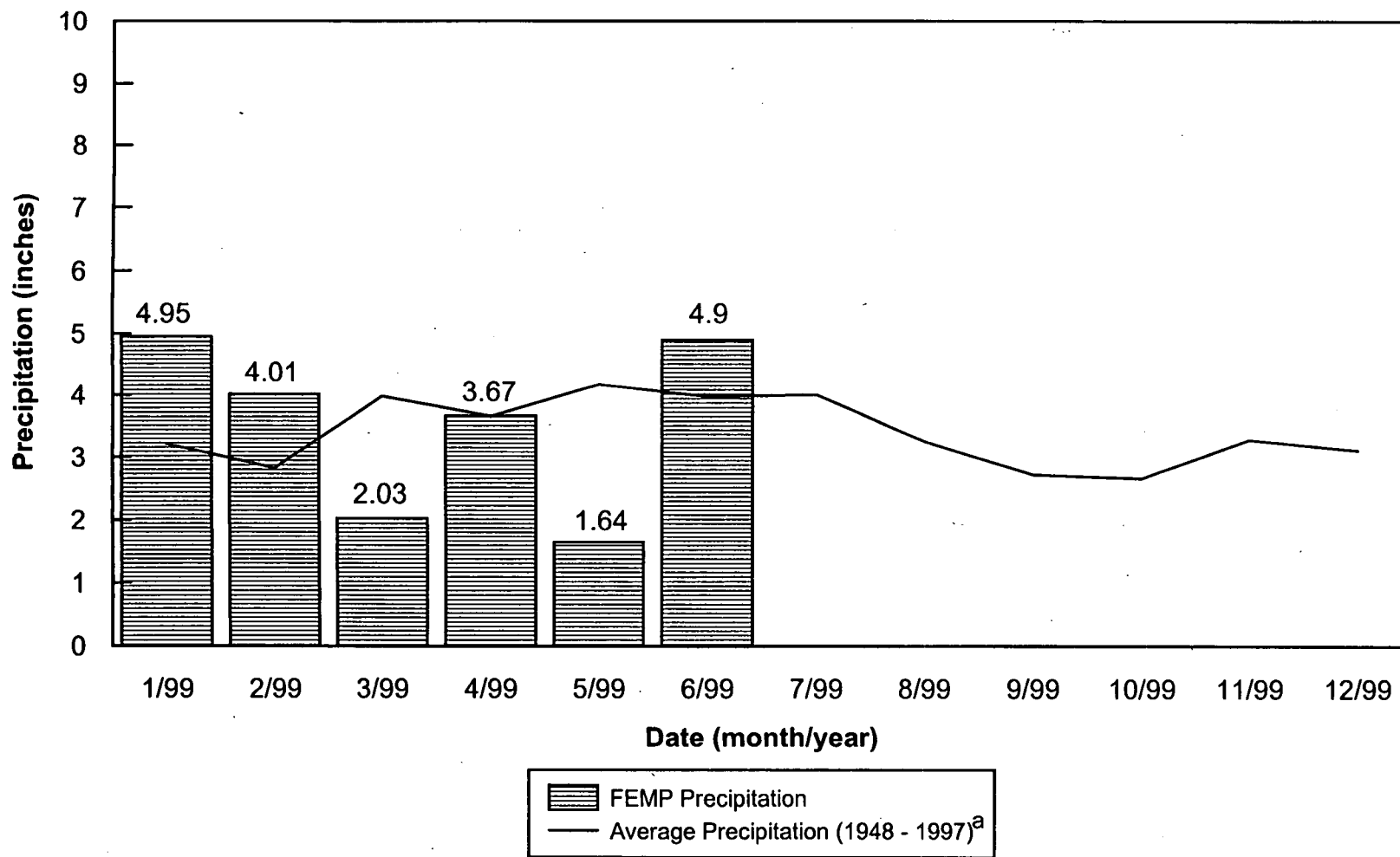
73



Note: Sum of monthly discharges may not always agree with cumulative total due to rounding differences.

FINAL

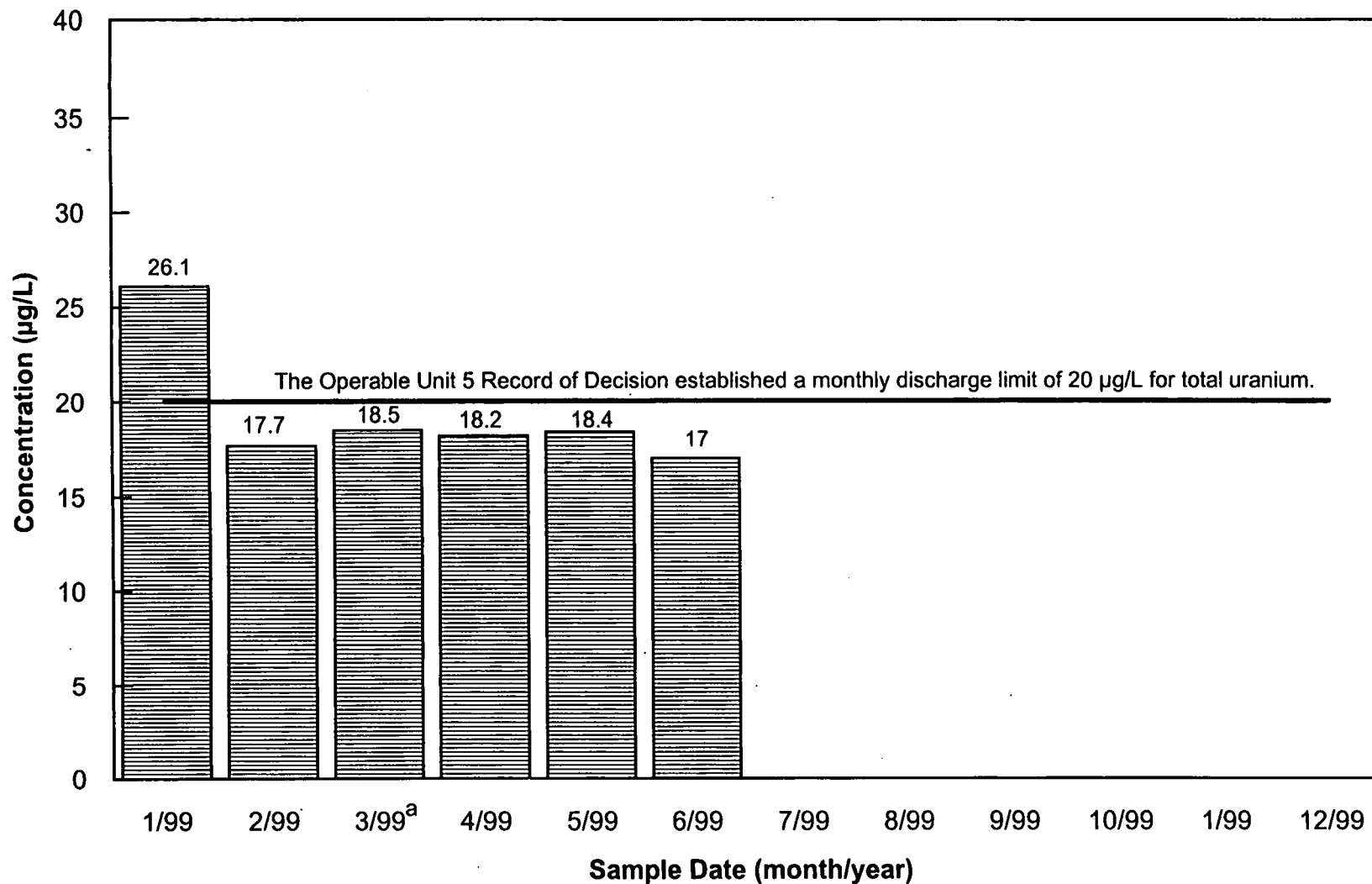
FIGURE 2-3. POUNDS OF URANIUM DISCHARGED TO THE GREAT MIAMI RIVER FROM THE PARSHALL FLUME (PF 4001) IN 1999



FINAL

FIGURE 2-4. 1999 FEMP MONTHLY PRECIPITATION DATA

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a) Actual concentration was 19.4 µg/L. Eliminating the three "treatment plant maintenance" bypass days reduces average to 18.5 µg/L.

FINAL

FIGURE 2-5. 1999 MONTHLY AVERAGE TOTAL URANIUM CONCENTRATION IN WATER DISCHARGED FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

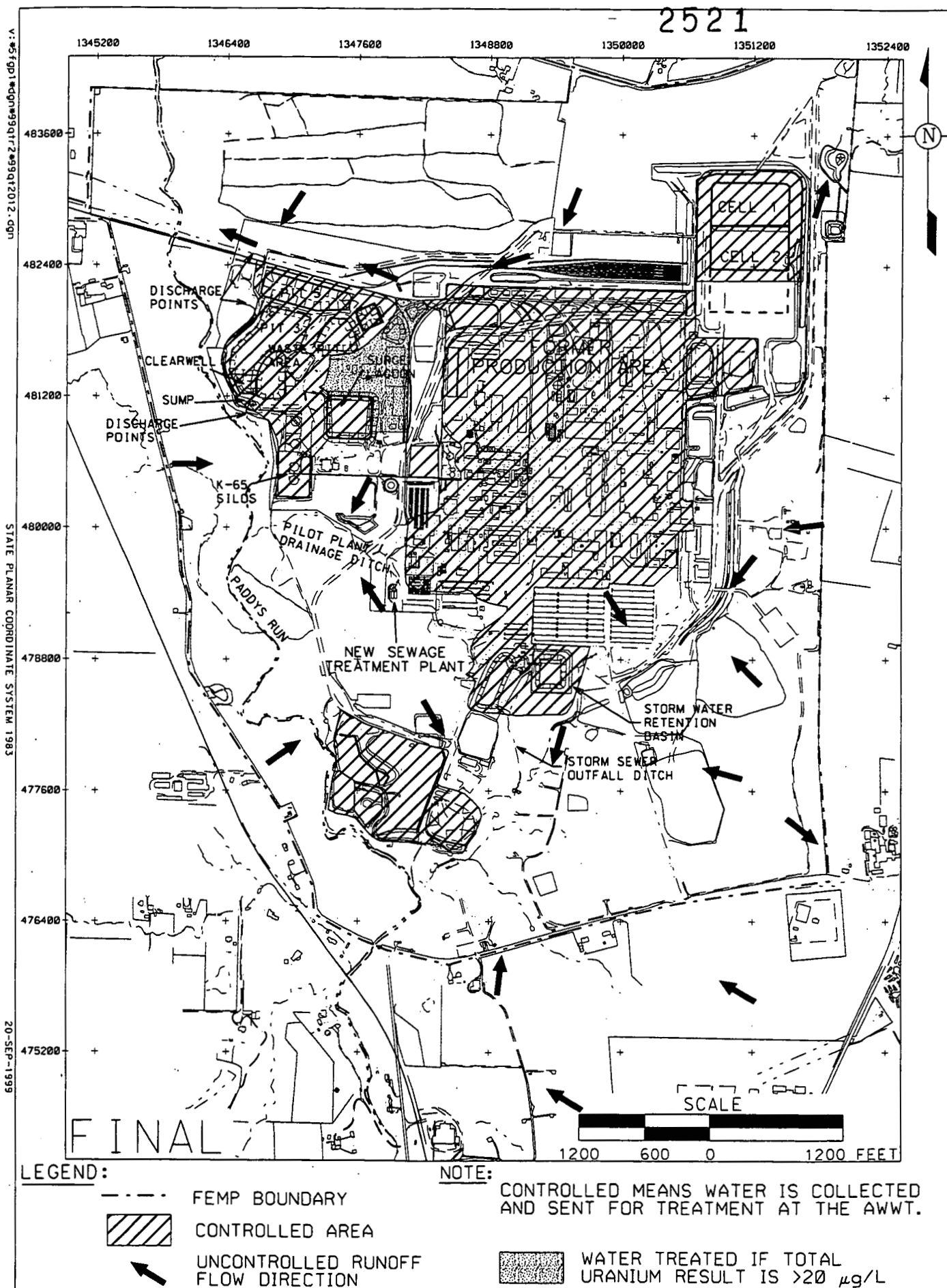


FIGURE 2-6. CONTROLLED SURFACE WATER AREAS AND UNCONTROLLED FLOW DIRECTIONS FOR SECOND QUARTER 1999

76

Note: The surface water FRL for total uranium is 530 µg/L.

Statistics from SWP-03:

No. of Samples: 16

Min.: 1.337 µg/L

Max.: 18 µg/L

Avg.: 3.5 µg/L

Median: 2.38 µg/L

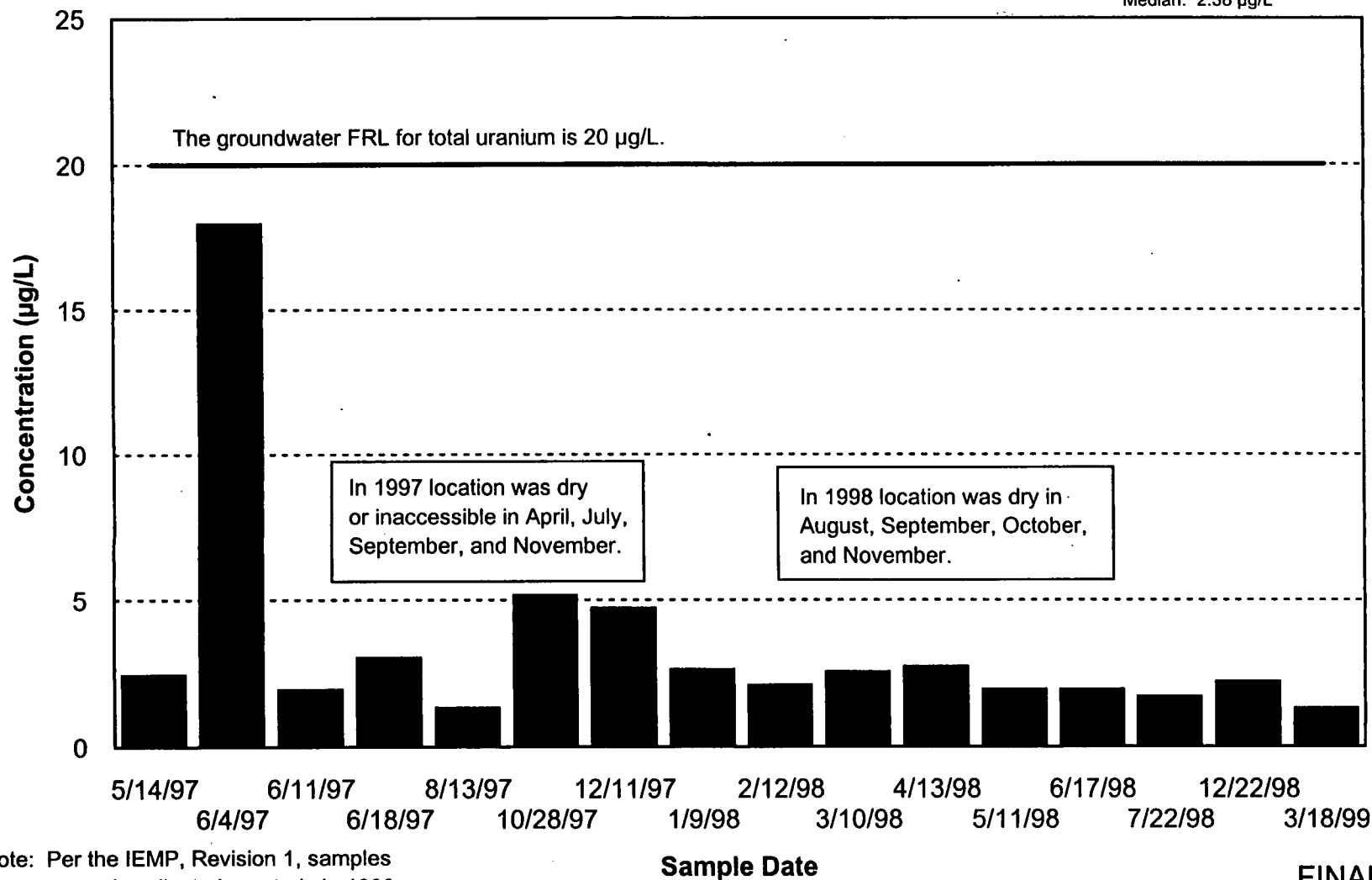


FIGURE 2-7. TOTAL URANIUM CONCENTRATIONS IN PADDYS RUN  
AT WILLEY ROAD (SWP-03) SAMPLE LOCATION

FIGURE 2-8

SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

**SAMPLING ACTIVITIES**

NPDES

FFCA

IEMP Characterization

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
						◆	◆	◆			
						◆	◆	◆			
			◆	◆	◆						

◆ Data summarized/  
evaluated in the next report

2521

FINAL

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### 3.0 AIR MONITORING UPDATE

#### 3.1 INTRODUCTION

This section provides a summary of the second quarter 1999 monitoring activities and analytical results for the IEMP air monitoring program. Figure 3-1 shows the data included in this section. Analytical results from the following routine air monitoring program elements and project-specific air monitoring activities covered in this section include:

- Radiological Air Particulate Monitoring:
  - National Emissions Standards for Hazardous Air Pollutants (NESHAP) Compliance
  - Project-Specific Air Monitoring at the Sewage Treatment Plant Complex
  - Air Particulate Monitoring Research Project
- Radon Monitoring:
  - Continuous Alpha Scintillation Monitoring - Silo Head Space and Environmental Data
- Direct Radiation Monitoring (via thermoluminescent dosimeters [TLDs])
- NESHAP Stack Emissions Monitoring.

#### 3.2 FINDINGS

The principal findings from this reporting period are summarized below:

##### **Radiological Air Particulate Monitoring**

- Second quarter 1999 uranium concentrations are comparable to first quarter 1999 uranium concentrations and, in general, reflect the lower levels of earth moving and waste hauling remediation work due to the delayed opening of the on-site disposal facility. Table 3-1 provides a summary of second quarter and historical total uranium concentrations.  
  
(Figure 3-2 identifies the location of the air monitoring stations and Figure 3-3 shows second quarter 1999 wind rose data.)
- As indicated in Figures 3-4 through 3-9, a general increase in particulate concentrations occurred at fenceline and background locations during the second quarter of 1999 as compared with first quarter 1999 particulate concentrations. The increase in second quarter concentrations reflects the increase in particulates associated

with springtime and the start of farming and construction activities. (Table 3-2 provides a summary of second quarter, year to date, and historical total particulate concentrations.)

- During the second quarter, the biweekly thorium concentrations measured at WPTH-1 and WPTH-2 were comparable to first quarter 1999 concentrations (refer to Figure 3-2 for WPTH-1 and WPTH-2 locations). These monitors were installed to address potential increases in airborne thorium concentrations, specifically thorium-230, resulting from fugitive emissions from the excavation of the waste pits which is scheduled to begin in late 1999. Data from these monitors are plotted on Figures 3-10 and 3-11. All data collected prior to the initiation of pit excavations will serve as baseline monitoring data for future evaluations.

### NESHAP Compliance

- The maximum second quarter dose equivalent, calculated from the second quarter air composite data, was 0.115 millirem (mrem) which occurred at AMS-3. Table 3-3 contains the second quarter doses for each fenceline monitoring location and the fractional contribution of each radionuclide to the total dose.
- Evaluation of the data associated with the second quarter composite samples indicated that the off-site laboratory initially encountered interferences during the thorium analysis which resulted in low tracer recoveries. During re-analysis of the samples, thorium recoveries improved, but interferences with thorium-228 results were observed at four monitoring stations. When the second quarter data were validated, the interferences lead to the rejection of the thorium-228 results from two fenceline air monitoring stations (AMS-24 and AMS-25) and the background monitors (AMS-12 and AMS-16). In order to account for concentrations of thorium-228 at each of the monitors, thorium-228 was assumed to be in equilibrium with its parent, thorium-232. This assumption is supported by the thorium-228/thorium-232 equilibrium conditions which occurred at the other fenceline monitors during the second quarter.
- The maximum year-to-date dose equivalent, calculated from the sum of the first and second quarterly air composites, was 0.125 mrem which occurred at AMS-3. This maximum fenceline dose represents 1.25 percent of the 10 mrem NESHAP Subpart H standard. Table 3-4 contains the year-to-date doses for each fenceline monitoring location and the fractional contribution of each radionuclide to the total dose. The year-to-date results indicate that on average, uranium contributed 22 percent, thorium contributed 46 percent, and radium-226 contributed 30 percent of the dose at the fenceline monitors. While these percentages are inconsistent with historical data, which shows uranium to be the major contributor to dose, the percentages are consistent with the contributions to dose as measured at the background monitoring stations. At the background stations, uranium contributed 17 percent, thorium contributed 56 percent, and radium-226 contributed 24 percent of the year-to-date dose. The similarity between the percentage contributions and relative ranking of the contributors to dose at the fenceline and background monitors suggests that the year-to-date fenceline dose is attributable to the fugitive emissions of soil with radionuclide composition similar to the windblown soil measured at the background

monitoring locations. Although uranium is not currently the major contributor to fenceline dose, the composition of fugitive emissions from the site is expected to change during the third quarter due to operations at the on-site disposal facility. Therefore, no changes to the IEMP analytical program are proposed at this time.

### Project-Specific Air Monitoring

- Project-specific environmental radiological air monitoring for the dismantlement of the Sewage Treatment Plant Complex continued through the second quarter of 1999. On May 25, 1999, project-specific monitor STP-1 was relocated to the FEMP fenceline, approximately 100 feet east and 75 feet south (refer to Figure 3-2) of the original location. The new location was designated as STP-2. This relocation was performed in order to accommodate below-grade excavations of the Sewage Treatment Plant Complex.
- Second quarter total uranium and total particulate concentrations at STP-1 and STP-2 were comparable to first quarter STP-1 results (refer to Tables 3-1, 3-2, and Figure 3-12).

### Air Particulate Monitoring Research Project

- Due to mechanical problems, the DOE Environmental Measurements Laboratory (DOE-EML) air sampling equipment continued to be out of service through the second quarter of 1999. When returned to service (expected to occur early in third quarter 1999), the sampler(s) should improve the detection limit of the DOE-EML analyses. Additional progress on this research project will be included in future IEMP quarterly status reports.

### Radon Monitoring

- As expected, the highest continuous environmental radon monitoring results were recorded at the K-65 exclusion fence resulting from radon emissions from the K-65 Silos. Over time, there has been a gradual increase in radon levels recorded at the exclusion fence corresponding to the increase in the K-65 Silo head space concentrations. In general, the four K-65 exclusion fence monitors (refer to Figure 3-13) recorded higher monthly average radon levels than the same monthly periods in 1998. Table 3-5 summarizes data from the second quarter of 1999, with ranges of monthly average concentrations for the first two quarters of 1999 and all of 1998. The maximum monthly average was 15.6 picoCuries per liter (pCi/L) and was recorded at location KNE in the prevailing wind direction.
- Recognizing that K-65 Silo head space radon concentrations fluctuate seasonally due to changes in physical parameters (i.e., temperature, barometric pressure, humidity, etc.), concentrations are summarized quarterly (from the daily average concentrations) in an attempt to identify changes under similar meteorological conditions (refer to Figure 3-14). Second quarter 1999 monthly average continuous monitoring results for K-65 Silo 1 ranged between 12.5 and 13.0 million pCi/L. The quarterly average concentration increased approximately 15 percent over the quarterly average

concentration during the same period in 1998 and is approximately 49 percent of the pre-bentonite concentration level (~26 million pCi/L). Second quarter 1999 monthly average continuous monitoring results for K-65 Silo 2 ranged between 8.10 and 8.50 million pCi/L. The quarterly average concentration decreased approximately 2 percent from the average concentrations during the same period in 1998 and is approximately 28 percent of the pre-bentonite concentration level (~30 million pCi/L).

(Figure 3-14 shows the quarterly silo head space radon concentrations and Table 3-6 presents the monthly average silo head space radon concentrations.)

- During the second quarter of 1999, there were 12 exceedances of DOE Order 5400.5 100 pCi/L radon limit recorded at the K-65 Silo exclusion fenceline. Table 3-7 lists the exceedances chronologically with their duration (in hours), effected monitoring locations, and the maximum hourly concentration.

As previously documented in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1998 (DOE 1999d) and the integrated Environmental Monitoring Status Report for First Quarter 1999, DOE conducted detailed inspections of the silo domes and maintenance activities in response to the increasing radon concentrations in the vicinity of the K-65 Silos. Initial maintenance activities were conducted and completed in December 1998. Additionally, DOE evaluated the following control measures to decrease radon emissions:

- Reducing the radon reaching the silo headspace from the K-65 residues by either repairing or adding to the bentonite diffusion barrier
- Reducing the quantity of radon emitted from the K-65 Silos by identifying and sealing leaks (re-foaming) in the dome with a spray-on coating and/or impermeable membrane
- Reducing the quantity of radon emitted from the K-65 Silos by maintaining the head space at a slight negative pressure relative to ambient air.

Based on keeping work area exposures As Low As Reasonably Achievable, DOE decided on re-foaming the identified areas. Re-foaming activities were initiated in late May 1999 and were completed on June 4, 1999. DOE continues to monitor the continuous radon data closely to gauge the effectiveness of this interim control measure until radon emissions are mitigated through implementation of the Accelerated Waste Retrieval Project. The radon control system associated with the Accelerated Waste Retrieval Project is predicted to be operational in 2001.

### Direct Radiation (TLD) Monitoring

- All monitoring results from direct radiation measurements for the second quarter of 1999 were within historical ranges (refer to Figure 3-15 for monitoring locations and Table 3-8 for direct radiation measurements). As noted in previous IEMP quarterly status reports, a positive trend in the immediate area of the K-65 Silos (locations 22 through 26) has been identified and will continue to be monitored

(refer to Figure 3-16). This trend is attributed to a corresponding increase in radon-progeny concentrations observed in the K-65 Silo head space. The increase in direct radiation measurements adjacent to the silos is still well below the levels observed prior to the addition of bentonite to the silos in 1991.

A slight positive trend at the site fenceline nearest the K-65 Silos (location 6) is attributed to the corresponding increase in radon head space concentrations. Figure 3-17 shows the slight positive trend at location 6, the fenceline location which is closest to the K-65 Silos.

### NESHAP Stack Emissions Monitoring

- Second quarter 1999 results for the Laundry and Building 71 stacks are within expected ranges. Typically, post production (1991 to present) stack monitoring results are near or below the minimum detectable concentration (MDC) levels for all isotopes monitored. Building 71 stack results indicated a reduction in total uranium emissions from the first quarter results (4.4  $\mu\text{g}/\text{filter}$ ) to less than MDC (0.9  $\mu\text{g}/\text{filter}$ ) for the second quarter results. No significant changes in the source operations associated with either stack were noted.

(Refer to Table 3-9 for NESHAP stack emission monitoring results and Figure 3-18 for NESHAP stack emission monitoring locations.)

Figure 3-19 shows the data from the air monitoring activities that will be included in the next IEMP quarterly status report. The next IEMP quarterly status report, to be issued in December 1999, will include data from air monitoring activities from July through September 1999 (third quarter).

Monitoring activities defined under the IEMP for radiological particulate, radon, direct radiation, and stack monitoring will continue as planned during the third quarter of 1999.

**TABLE 3-1**  
**TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR**

Location <sup>a</sup>	Second Quarter 1999 Results <sup>b</sup> (pCi/m <sup>3</sup> x 1E-6)				1999 Summary Results <sup>b</sup> (pCi/m <sup>3</sup> x 1E-6)				1990 through 1998 Summary Results <sup>b,c</sup> (pCi/m <sup>3</sup> x 1E-6)	
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
<b>Fenceline</b>										
AMS-2	7	11	50	30	13	10	142	35	0	3500
AMS-3	7	13	119	43	13	13	119	46	0	17000
AMS-4	7	0	41	17	13	0	65	21	0	2300
AMS-5	7	0	26	11	13	0	30	14	0	4400
AMS-6	7	3.2	51	20	13	3	59	25	0	3200
AMS-7	7	0	24	11	13	0	40	15	0	7800
AMS-8A	7	0	156	52	13	0	156	49	7.9	900
AMS-9C <sup>d</sup>	7	14	144	60	13	14	144	55	0	562
AMS-22	7	0	35	15	13	0	49	26	0	101
AMS-23	7	0	35	20	13	0	47	20	9.0	194
AMS-24	7	0	33	19	13	0	44	16	0	65
AMS-25	7	0	42	18	13	0	42	15	0	79
AMS-26	7	0	75	20	13	0	75	22	0	98
AMS-27	7	0	36	17	13	0	48	21	0	64
AMS-28	7	0	62	21	13	0	62	18	0	216
AMS-29	7	0	57	23	13	0	57	21	0	121
<b>Background</b>										
AMS-12	7	0	14	5.0	13	0	20	8.3	0	480
AMS-16	7	0	25	16	13	0	33	19	0	350
<b>Project-Specific</b>										
STP-1 <sup>e,f</sup>	5	20	65	44	11	20	143	56	38	891
STP-2 <sup>f</sup>	3	5.4	158	72	3	5.4	158	72	NA	NA

<sup>a</sup>Refer to Figure 3-2<sup>b</sup>For blank corrected concentrations less than or equal to 0.0 pCi/m<sup>3</sup>, the concentration is set as 0.0 pCi/m<sup>3</sup>.<sup>c</sup>NA = not applicable<sup>d</sup>Summary results for 1990 through 1998 include AMS-9B/C data.<sup>e</sup>Project-specific monitor was not in operation prior to 1997.<sup>f</sup>STP-1 was relocated to STP-2 on May 25, 1999.

TABLE 3-2

TOTAL PARTICULATE CONCENTRATIONS IN AIR

Location <sup>a</sup>	Second Quarter 1999 Results ( $\mu\text{g}/\text{m}^3$ )				1999 Summary Results ( $\mu\text{g}/\text{m}^3$ )				1990 through 1998 Summary Results <sup>b</sup> ( $\mu\text{g}/\text{m}^3$ )	
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
<b>Fenceline</b>										
AMS-2	7	11	61	37	13	11	69	34	7.0	77
AMS-3	7	26	74	44	13	19	74	33	8.0	159
AMS-4	7	37	74	51	13	18	74	40	13	79
AMS-5	7	25	45	34	13	20	45	30	9.6	62
AMS-6	7	24	48	38	13	19	48	30	8.0	69
AMS-7	7	23	48	37	13	22	48	31	6.8	76
AMS-8A	7	27	63	47	13	20	63	35	13	89
AMS-9C <sup>c</sup>	7	29	58	47	13	19	58	36	7.1	136
AMS-22	7	30	53	42	13	16	53	39	13	57
AMS-23	7	23	57	39	13	19	57	30	15	51
AMS-24	7	27	56	44	13	22	56	35	18	79
AMS-25	7	22	45	35	13	17	45	29	21	69
AMS-26	7	27	52	39	13	21	52	32	15	51
AMS-27	7	41	67	56	13	30	67	47	24	86
AMS-28	7	20	51	35	13	15	51	26	12	49
AMS-29	7	26	52	41	13	18	52	32	11	62
<b>Background</b>										
AMS-12 <sup>d</sup>	7	21	48	35	13	16	48	28	6.0	416
AMS-16 <sup>d</sup>	7	37	60	48	13	26	60	42	18	84
<b>Project-Specific</b>										
STP-1 <sup>e,f</sup>	5	28	54	40	11	21	54	31	25	93
STP-2 <sup>f</sup>	3	44	68	56	3	44	68	56	NA	NA

<sup>a</sup>Refer to Figure 3-2

<sup>b</sup>NA = not applicable

<sup>c</sup>Summary results for 1990 through 1998 include AMS-9B/C data.

<sup>d</sup>Total particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.

<sup>e</sup>Project-specific monitor was not in operation prior to 1997.

<sup>f</sup>STP-1 was relocated to STP-2 on May 25, 1999.

TABLE 3-3

SECOND QUARTER NESHAP COMPLIANCE TRACKING

40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios<sup>b</sup>

Location <sup>a</sup>	Actinium-228 <sup>c</sup>	Radium-224 <sup>c</sup>	Radium-226	Radium-228 <sup>c</sup>	Thorium-228	Thorium-230	Thorium-231 <sup>c</sup>	Thorium-232	Thorium-234 <sup>c</sup>	Uranium-234	Uranium-235	Uranium-236	Uranium-238	Ratio Totals	Dose <sup>d</sup> (mrem)
<b>Fenceline</b>															
AMS-2	6.8E-07	1.7E-05	2.9E-03	4.2E-04	8.9E-04	9.7E-04	4.5E-10	4.0E-03	8.7E-07	2.0E-04	1.8E-05	2.3E-04	9.7E-03	0.097	
AMS-3	1.9E-07	4.6E-06	7.9E-03	1.2E-04	2.5E-04	4.2E-04	5.5E-10	1.1E-03	3.1E-06	8.0E-04	2.2E-05	8.3E-04	1.1E-02	0.115	
AMS-4	4.8E-07	1.2E-05	4.1E-04	3.0E-04	4.6E-03	7.3E-04	0.0E+00	2.9E-03	1.2E-06	2.0E-04	0.0E+00	3.3E-04	9.4E-03	0.094	
AMS-5	1.7E-07	4.3E-06	0.0E+00	1.1E-04	1.4E-04	3.3E-04	0.0E+00	1.0E-03	4.3E-07	5.3E-05	0.0E+00	1.1E-04	1.8E-03	0.018	
AMS-6	1.1E-07	2.8E-06	4.5E-04	7.0E-05	1.2E-04	2.2E-04	6.8E-10	6.7E-04	1.1E-06	1.6E-04	2.6E-05	2.9E-04	2.0E-03	0.020	
AMS-7	1.6E-07	3.9E-06	0.0E+00	9.8E-05	2.6E-04	3.0E-04	0.0E+00	9.3E-04	1.7E-07	5.6E-05	0.0E+00	4.6E-05	1.7E-03	0.017	
AMS-8A	2.5E-07	6.2E-06	2.6E-03	1.6E-04	3.5E-04	4.1E-04	7.0E-10	1.5E-03	3.0E-06	6.6E-04	2.8E-05	7.9E-04	6.5E-03	0.065	
AMS-9C	3.6E-07	8.8E-06	2.0E-03	2.2E-04	4.6E-04	5.2E-04	1.6E-09	2.1E-03	4.0E-06	9.7E-04	6.1E-05	1.1E-03	7.4E-03	0.074	
AMS-22	3.6E-07	9.0E-06	0.0E+00	2.3E-04	5.0E-04	6.8E-04	4.0E-10	2.2E-03	1.3E-06	2.6E-04	1.6E-05	3.5E-04	4.2E-03	0.042	
AMS-23	1.1E-07	2.8E-06	0.0E+00	7.1E-05	1.9E-04	1.9E-04	0.0E+00	6.7E-04	8.3E-07	1.7E-04	0.0E+00	2.2E-04	1.5E-03	0.015	
AMS-24	0.0E+00	0.0E+00	1.9E-03	0.0E+00	0.0E+00 <sup>e</sup>	0.0E+00	0.0E+00	0.0E+00	8.4E-07	2.2E-04	0.0E+00	2.2E-04	2.4E-03	0.024	
AMS-25	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00 <sup>e</sup>	0.0E+00	3.1E-10	0.0E+00	7.1E-08	0.0E+00	1.2E-05	1.9E-05	3.1E-05	0.000	
AMS-26	7.0E-08	1.7E-06	1.6E-03	4.4E-05	1.0E-04	1.4E-04	6.2E-10	4.2E-04	1.3E-06	4.5E-04	2.4E-05	3.5E-04	3.1E-03	0.031	
AMS-27	3.8E-07	9.4E-06	4.3E-03	2.4E-04	4.9E-04	5.6E-04	0.0E+00	2.3E-03	8.5E-07	1.2E-04	0.0E+00	2.2E-04	8.2E-03	0.082	
AMS-28	8.8E-08	2.2E-06	0.0E+00	5.5E-05	1.5E-04	1.2E-04	1.8E-10	5.2E-04	5.0E-07	3.7E-05	6.9E-06	1.3E-04	1.0E-03	0.010	
AMS-29	1.9E-07	4.6E-06	0.0E+00	1.2E-04	1.2E-03	3.5E-04	5.7E-10	1.1E-03	1.2E-06	1.9E-04	2.2E-05	3.1E-04	3.3E-03	0.033	
<b>Background</b>															
AMS-12	1.9E-07	4.7E-06	8.2E-04	1.2E-04	2.3E-04 <sup>e</sup>	2.9E-04	0.0E+00	1.1E-03	1.2E-06	3.7E-04	0.0E+00	3.2E-04	NA <sup>f</sup>		
AMS-16	4.2E-07	1.0E-05	5.2E-03	2.6E-04	5.0E-04 <sup>e</sup>	6.4E-04	4.5E-10	2.5E-03	1.6E-06	5.1E-04	1.8E-05	4.3E-04	NA <sup>f</sup>		

Maximum Quarterly Ratio: 0.0115

Maximum Quarterly Dose (mrem): 0.115

<sup>a</sup>Refer to Figure 3-2

<sup>b</sup>A ratio of 0.0+00 indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.

<sup>c</sup>Isotopes assumed to be in equilibrium with their parents.

<sup>d</sup>Dose conversions are based on the NESHAP standard of 10 mrem per year.

<sup>e</sup>Second quarter thorium-228 data were rejected during validation and assumed to be in equilibrium with its parent, thorium-232.

<sup>f</sup>NA = not applicable

TABLE 3-4

## YEAR-TO-DATE NESHAP COMPLIANCE TRACKING

40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios<sup>b</sup>

Location <sup>a</sup>	Actinium-228 <sup>c</sup>	Radium-224 <sup>c</sup>	Radium-226 <sup>d</sup>	Radium-228 <sup>c</sup>	Thorium-228	Thorium-230	Thorium-231 <sup>c</sup>	Thorium-232	Thorium-234 <sup>c</sup>	Uranium-234	Uranium-235 Uranium-236	Uranium-238	Ratio Totals	Dose <sup>e</sup> (mrem)
<b>Fenceline</b>														
AMS-2	6.8E-07	1.7E-05	2.9E-03	4.2E-04	8.9E-04	9.7E-04	9.2E-10	4.0E-03	1.9E-06	4.1E-04	3.6E-05	5.1E-04	1.0E-02	0.102
AMS-3	1.9E-07	4.6E-06	7.9E-03	1.2E-04	2.5E-04	4.2E-04	5.5E-10	1.1E-03	5.2E-06	1.3E-03	2.2E-05	1.4E-03	1.3E-02	0.125
AMS-4	4.8E-07	1.2E-05	8.9E-04	3.0E-04	4.6E-03	7.3E-04	2.7E-10	2.9E-03	1.7E-06	2.2E-04	1.1E-05	4.5E-04	1.0E-02	0.100
AMS-5	1.7E-07	4.3E-06	0.0E+00	1.1E-04	1.4E-04	3.3E-04	0.0E+00	1.0E-03	6.0E-07	5.3E-05	0.0E+00	1.6E-04	1.8E-03	0.018
AMS-6	1.1E-07	2.8E-06	4.5E-04	7.0E-05	1.2E-04	2.2E-04	1.1E-09	6.7E-04	1.8E-06	3.7E-04	4.2E-05	4.9E-04	2.4E-03	0.024
AMS-7	1.6E-07	3.9E-06	0.0E+00	9.8E-05	2.6E-04	3.0E-04	0.0E+00	9.3E-04	1.2E-06	3.6E-04	0.0E+00	3.1E-04	2.3E-03	0.023
AMS-8A	2.5E-07	6.2E-06	2.8E-03	1.6E-04	3.5E-04	4.1E-04	7.0E-10	1.5E-03	4.7E-06	1.1E-03	2.8E-05	1.2E-03	7.6E-03	0.076
AMS-9C	3.6E-07	8.8E-06	2.0E-03	2.2E-04	4.6E-04	8.7E-04	2.0E-09	2.1E-03	6.6E-06	1.7E-03	7.7E-05	1.8E-03	9.2E-03	0.092
AMS-22	3.6E-07	9.0E-06	5.4E-04	2.3E-04	5.0E-04	6.8E-04	6.8E-10	2.2E-03	4.0E-06	7.7E-04	2.7E-05	1.1E-03	6.0E-03	0.060
AMS-23	1.1E-07	2.8E-06	0.0E+00	7.1E-05	1.9E-04	5.1E-04	0.0E+00	6.7E-04	1.3E-06	3.1E-04	0.0E+00	3.5E-04	2.1E-03	0.021
AMS-24	0.0E+00	0.0E+00	1.9E-03	0.0E+00	0.0E+00 <sup>f</sup>	0.0E+00	2.3E-10	0.0E+00	8.4E-07	2.2E-04	9.2E-06	2.2E-04	2.4E-03	0.024
AMS-25	0.0E+00	0.0E+00	3.7E-04	0.0E+00	0.0E+00 <sup>f</sup>	0.0E+00	3.1E-10	0.0E+00	7.1E-08	0.0E+00	1.2E-05	1.9E-05	4.0E-04	0.004
AMS-26	7.0E-08	1.7E-06	1.6E-03	4.4E-05	1.0E-04	1.4E-04	7.9E-10	4.2E-04	2.3E-06	6.3E-04	3.1E-05	6.0E-04	3.6E-03	0.036
AMS-27	3.8E-07	9.4E-06	4.3E-03	2.4E-04	4.9E-04	7.4E-04	0.0E+00	2.3E-03	1.4E-06	2.6E-04	0.0+00	3.8E-04	8.7E-03	0.087
AMS-28	8.8E-08	2.2E-06	3.6E-04	5.5E-05	1.5E-04	1.9E-04	1.8E-10	5.2E-04	5.0E-07	3.7E-05	6.9E-06	1.3E-04	1.5E-03	0.015
AMS-29	1.9E-07	4.6E-06	0.0E+00	1.2E-04	1.2E-03	5.0E-04	5.7E-10	1.1E-03	1.2E-06	2.4E-04	2.2E-05	3.1E-04	3.6E-03	0.036
<b>Background</b>														
AMS-12	3.6E-07	9.0E-06	8.2E-04	2.3E-04	4.8E-04 <sup>f</sup>	6.2E-04	5.8E-10	2.2E-03	2.0E-06	6.7E-04	2.3E-05	5.4E-04	NA <sup>g</sup>	
AMS-16	9.7E-07	2.4E-05	5.2E-03	6.1E-04	1.2E-03 <sup>f</sup>	1.4E-03	4.5E-10	5.8E-03	3.3E-06	9.7E-04	1.8E-05	8.7E-04	NA <sup>g</sup>	

Maximum Year-to-Date Ratio: 0.0125

Maximum Year-to-Date Dose (mrem): 0.125

<sup>a</sup>See Figure 3-2<sup>b</sup>A ratio of 0.0+00 indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.<sup>c</sup>Isotopes assumed to be in equilibrium with their parents.<sup>d</sup>First quarter 1999 radium-226 data were rejected and substituted with first quarter 1998 radium-226 data.<sup>e</sup>Dose conversions are based on the NESHAP standard of 10 mrem per year.<sup>f</sup>Second quarter thorium-228 data were rejected during validation and assumed to be in equilibrium with its parent, thorium-232.<sup>g</sup>NA = not applicable

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Revision 0  
September 24, 1999

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TABLE 3-5

**CONTINUOUS ENVIRONMENTAL RADON MONITORING  
MONTHLY AVERAGE CONCENTRATIONS**

Location <sup>a</sup>	Second Quarter 1999 Monthly Results <sup>b,c</sup> (Instrument Background Corrected) (pCi/L)			1999 Summary Results <sup>b</sup> (Instrument Background Corrected) (pCi/L)			1998 Summary Results <sup>b,c</sup> (Instrument Background Corrected) (pCi/L)		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
<b>Fenceline</b>									
AMS-02	0.2	0.4	0.3	0.2	0.4	0.3	0.2	0.7	0.4
AMS-03	0.1	0.5	0.4	0.1	0.5	0.3	0.6	0.8	0.7
AMS-04	0.2	0.4	0.3	0.1	0.4	0.2	0.1	0.7	0.4
AMS-05	0.2	0.5	0.4	0.2	0.5	0.3	0.2	1.3	0.6
AMS-06	0.4	0.4	0.4	0.2	0.4	0.4	0.2	0.9	0.5
AMS-07	0.4	0.6	0.6	0.3	0.6	0.5	0.2	1.5	0.7
AMS-08A <sup>d</sup>	0.1	0.3	0.2	0.1	0.8	0.4	0.8	NA	NA
AMS-09C	0.2	0.4	0.3	0.2	0.7	0.4	0.2	0.9	0.6
AMS-22	0.2	0.3	0.3	0.1	0.3	0.2	0.2	0.7	0.4
AMS-23	0.1	0.3	0.2	0.1	0.3	0.2	0.4	0.5	0.4
AMS-24 <sup>d</sup>	0.2	0.6	0.4	0.2	0.6	0.3	0.7	NA	NA
AMS-25 <sup>d</sup>	0.3	0.4	0.4	0.2	0.4	0.3	0.6	NA	NA
AMS-26	0.2	0.4	0.3	0.2	0.5	0.3	0.2	0.8	0.6
AMS-27	0.3	0.5	0.4	0.2	0.5	0.3	0.2	1.1	0.7
AMS-28 <sup>d</sup>	0.1	0.4	0.3	0.1	0.4	0.2	0.4	NA	NA
AMS-29 <sup>d</sup>	0.1	0.3	0.2	0.1	0.3	0.2	0.7	NA	NA
<b>Background</b>									
AMS-12	0.1	0.2	0.2	0.1	0.3	0.2	0.1	0.6	0.3
AMS-16	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.6	0.4
<b>On Site</b>									
KNE	6.5	15.6	10.4	6.5	18.3	11.6	2.0	18.2	9.1
KNW	2.8	3.7	3.3	2.7	4.0	3.3	1.0	4.8	2.4
KSE	3.6	7.0	5.5	3.6	9.9	6.2	2.4	16.9	8.3
KSW	2.2	3.2	2.7	2.2	4.1	3.2	1.4	5.2	3.1
KTOP	7.0	12.1	10.0	7.0	15.8	11.6	7.2	24.6	13.0
Pilot Plant Warehouse	0.3	0.4	0.3	0.3	0.4	0.3	0.1	0.9	0.4
Rally Point 4	0.5	0.5	0.5	0.5	1.3	0.7	0.2	1.3	0.7
Surge Lagoon <sup>e</sup>	NA	NA	NA	0.4	0.5	0.4	0.3	1.3	0.7
T28	1.2	2.8	1.9	1.2	2.8	1.7	0.9	2.8	1.8
TS4 <sup>f</sup>	0.2	0.4	0.3	0.2	0.5	0.3	NA	NA	NA
WP-17A	0.2	0.6	0.4	0.1	0.6	0.3	0.2	0.9	0.5

<sup>a</sup>Refer to Figure 3-13<sup>b</sup>Instrument background changes as monitors are replaced.<sup>c</sup>NA = not applicable<sup>d</sup>Unit was placed in service in December 1998.<sup>e</sup>Second quarter 1999 data are unavailable due to electrical outage from construction activities.<sup>f</sup>Unit was placed in service in January 1999.

**TABLE 3-6**  
**RADON HEAD SPACE CONCENTRATIONS**

Radon Head Space Concentrations <sup>a,b,c</sup> (pCi/L)												
Month	Silo 1 1999			Silo 1 1998			Silo 2 1999			Silo 2 1998		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
January	1.24E+07	1.44E+07	1.34E+07	1.06E+07	1.18E+07	1.13E+07	8.78E+06	1.11E+07	9.95E+06	8.24E+06	1.01E+07	9.10E+06
February	1.27E+07	1.35E+07	1.32E+07	1.06E+07	1.18E+07	1.12E+07	8.70E+06	9.68E+06	9.20E+06	8.02E+06	9.48E+06	8.96E+06
March	1.25E+07	1.33E+07	1.29E+07	1.01E+07	1.17E+07	1.10E+07	8.66E+06	9.89E+06	9.30E+06	7.27E+06	9.19E+06	8.45E+06
April	1.22E+07	1.30E+07	1.25E+07	9.89E+06	1.09E+07	1.05E+07	7.74E+06	8.53E+06	8.10E+06	7.34E+06	8.87E+06	8.14E+06
May	1.21E+07	1.32E+07	1.26E+07	1.05E+07	1.20E+07	1.10E+07	7.77E+06	8.73E+06	8.21E+06	8.38E+06	8.99E+06	8.62E+06
June	1.25E+07	1.36E+07	1.30E+07	1.08E+07	1.22E+07	1.15E+07	8.04E+06	9.08E+06	8.50E+06	8.25E+06	9.05E+06	8.62E+06

<sup>a</sup>Minimum equals minimum recorded daily average radon concentration.

<sup>b</sup>Maximum equals maximum recorded daily average radon concentration.

<sup>c</sup>Average equals monthly average of recorded daily radon concentrations.

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TABLE 3-7

**1999 SECOND QUARTER RADON CONCENTRATIONS  
100 pCi/L EXCEEDANCES AT THE K-65 SILOS 1 AND 2 EXCLUSION FENCE**

Exceedance Event Start Date	Duration of Exceedance (hours)	Maximum Recorded Hourly Radon Concentration (pCi/L)	Effectuated Monitoring Location(s) <sup>a,b</sup>
4/7	2	156	KSE, KNE
4/21	1	109	KNE
4/26	5	233	KNE
5/3	5	181	KNE
5/4	2	158	KNE
5/8	1	108	KNE
5/10	2	109	KNE
5/12	6	177	KNE
5/20	2	115	KNE
5/23	1	129	KNE
5/25	2	135	KNE
5/27	1	107	KNE

<sup>a</sup>The location listed first had the highest recorded concentration.

<sup>b</sup>Refer to Figure 3-13

**TABLE 3-8**  
**DIRECT RADIATION (TLD) MEASUREMENTS**

Location <sup>a</sup>	Direct Radiation (mrem)			
	First Quarter 1999 Results <sup>b</sup>	Second Quarter 1999 Results	1999 Summary Results <sup>c</sup>	1998 Summary Results <sup>b</sup>
<b>Fenceline</b>				
2	18	19	37	74
3	16	18	35	67
4	16	17	33	66
5	17	18	35	68
6	20	21	40	84
7	17	17	34	69
8A	17	20	37	75
9C	18	19	37	79
13	18	20	37	74
14	17	18	35	77
15	19	20	39	79
16	19	21	40	81
17	16	17	37	73
34	18	19	37	75
35	17	19	37	70
36	16	16	32	65
37	18	19	38	77
38	16	16	31	63
39	19	21	39	79
40	16	18	35	67
41	18	18	36	73
Min.	16	16	31	63
Max.	20	21	40	84
<b>On Site</b>				
22	207	211	418	776
23	230	211	441	817
23A	NA	220	460	NA
24	152	157	308	632
25	206	212	418	698
26	128	131	259	496
32	14	14	29	55
Min.	14	14	29	55
Max.	230	220	460	817
<b>Background</b>				
18	19	20	39	77
19	16	16	31	65
20	15	17	32	61
27	15	17	32	64
33	17	17	34	68
Min.	15	16	31	61
Max.	19	20	39	77

Refer to Figure 3-15

NA = not applicable

1999 summary result value may not always agree with quarterly results due to rounding differences.

Estimated second quarter direct radiation levels

Direct radiation levels for TLD locations 23 and 23A were extrapolated.

TLD location 23 was relocated to TLD location 23A on May 26, 1999.

Direct radiation value includes estimated second quarter results which were based on first quarter results.

**TABLE 3-9**  
**NESHAP STACK EMISSION MONITORING RESULTS**

Analysis Performed	Second Quarter 1999 Results		1999 Summary Results		1998 Summary Results	
	No. of Samples	Total Pounds <sup>a,b,c</sup>	No. of Samples	Total Pounds <sup>a,b</sup>	No. of Samples	Total Pounds <sup>a</sup>
<b>Building 71 Stack</b>						
Uranium, Total	1	ND	2	2.2E-05	5	1.3E-05
Thorium-232	1	2.0E-05	2	4.5E-05	5	8.6E-05
Thorium-230	1	3.7E-10	2	6.1E-10	5	1.2E-09
Total Particulate	0 <sup>d</sup>	NA	1	5.1E-03	1 <sup>d</sup>	7.2E-02
<b>Laundry Stack</b>						
Uranium, Total	2	ND	4	ND	10	7.0E-06
Thorium-232	2	1.6E-04	4	3.1E-04	10	4.5E-04
Thorium-230	2	1.9E-09	4	3.5E-09	10	5.8E-09
Total Particulate	2	1.9E-01	4	2.8E-01	8 <sup>d</sup>	1.1E+00

<sup>a</sup>Total pounds are only determined from detected results.

<sup>b</sup>ND = non-detectable

<sup>c</sup>NA = not applicable

<sup>d</sup>Some particulate result(s) could not be determined due to a damaged filter(s).

## AIR SAMPLING ACTIVITIES COVERED IN THIS QUARTERLY REPORT

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
			◆	◆	◆						
					◆						
			◆	◆	◆						
					◆						
			◆	◆	◆						

◆ Data summarized/  
evaluated in this report

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FINAL

V:\5f\001\400\109\0172\#99\012020.dgn

20-SEP-1999

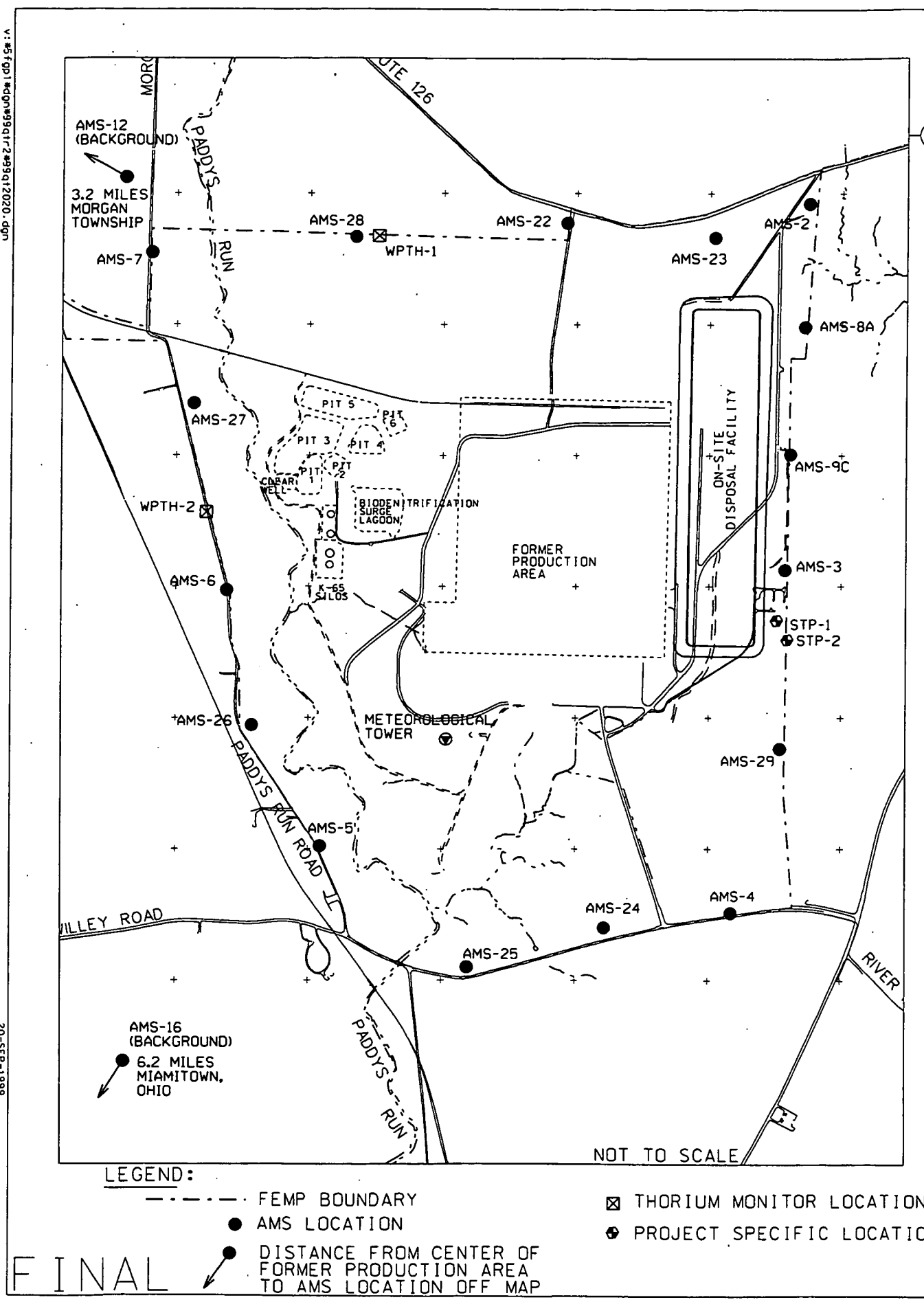
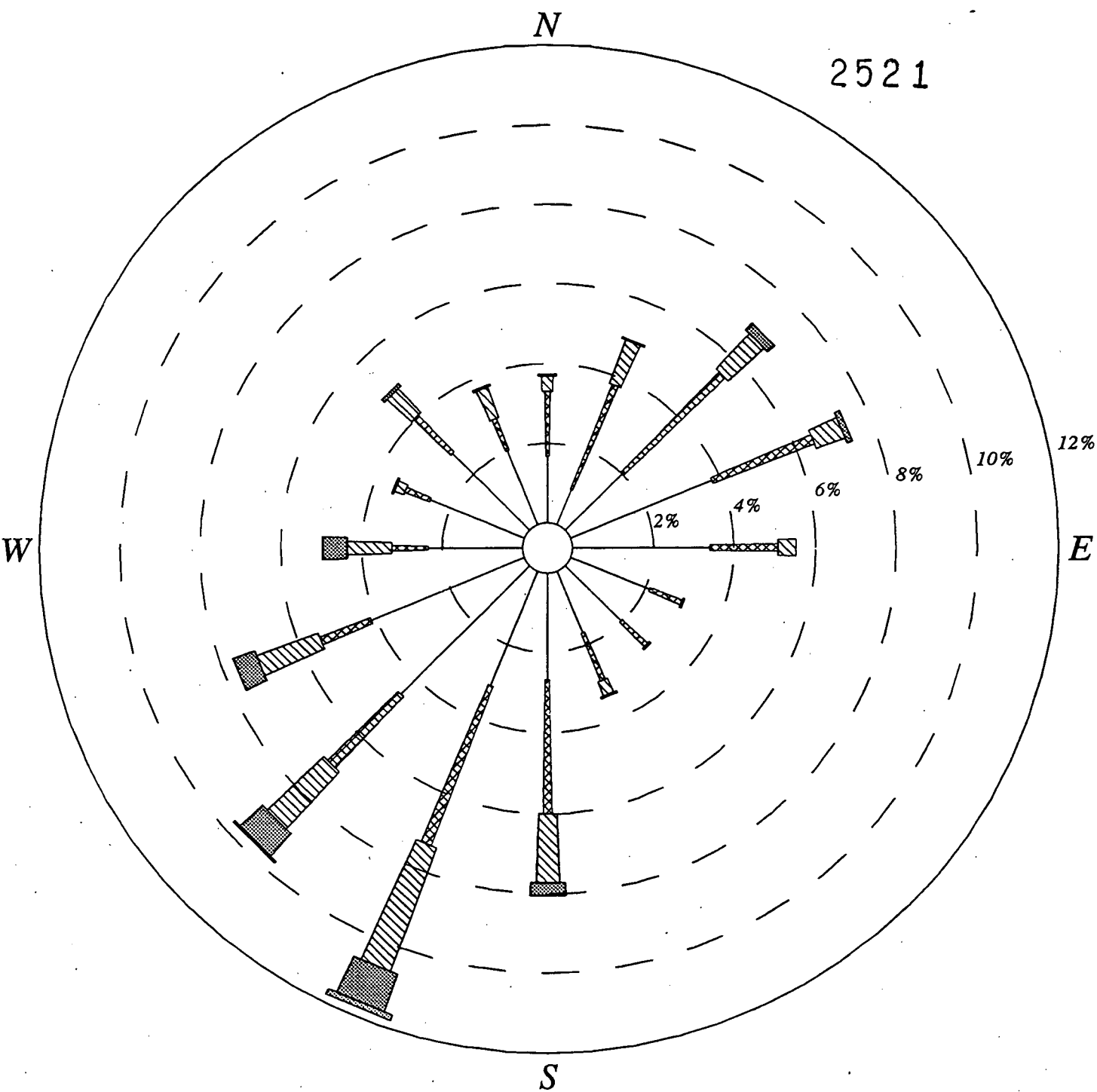


FIGURE 3-2. IEMP AIR MONITORING LOCATIONS

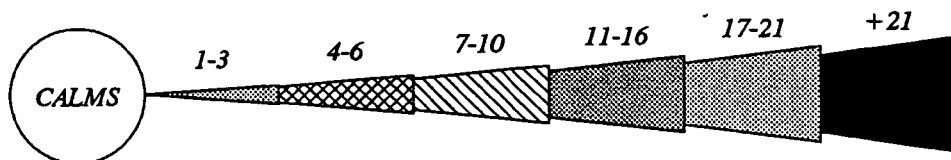
94



**CALM WINDS 7.72%**

**WIND SPEED (KNOTS)**

*NOTE: Frequencies indicate direction from which the wind is blowing.*



**FIGURE 3-3. SECOND QUARTER 1999 WIND ROSE DATA, 10-METER HEIGHT**

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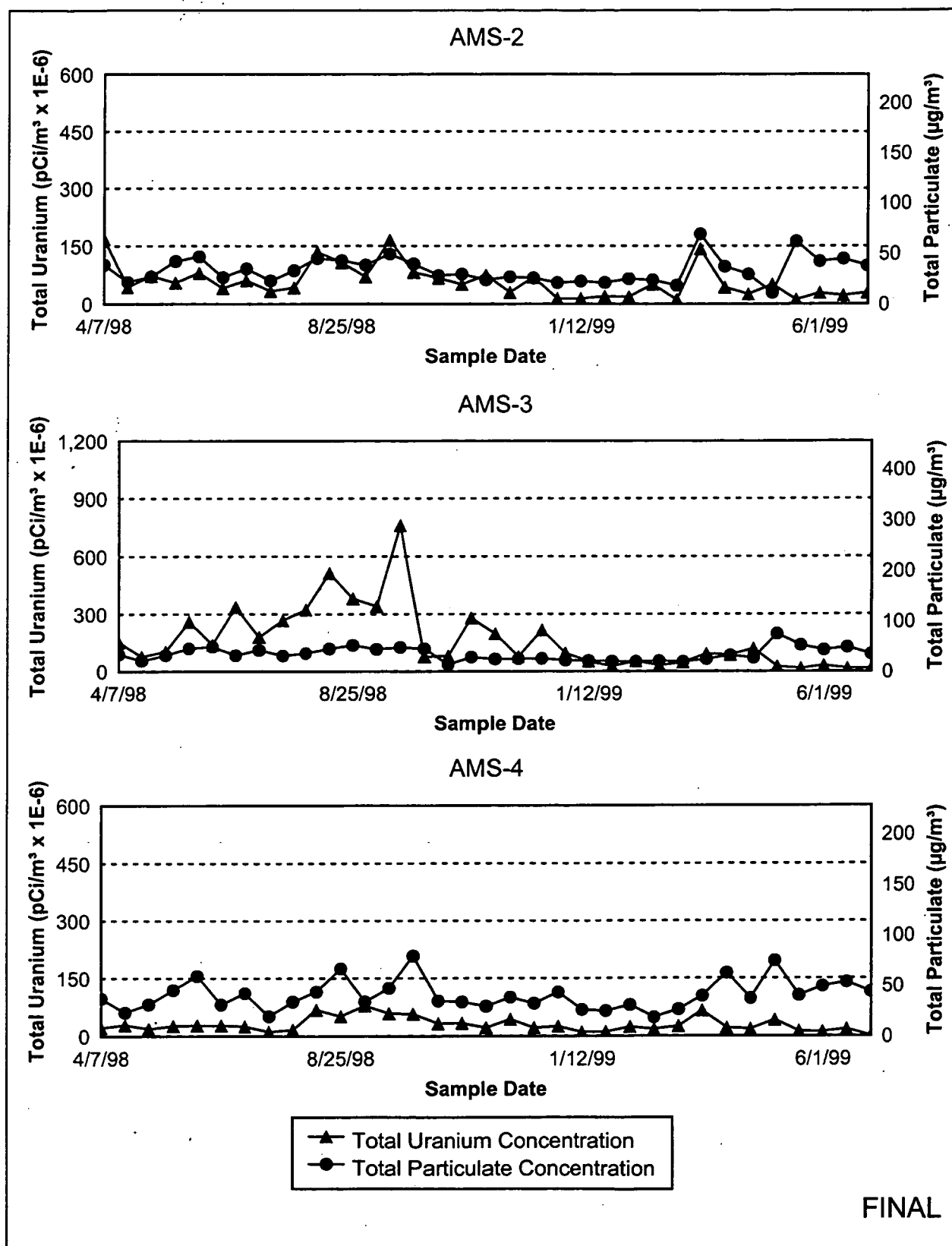


FIGURE 3-4. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-2, AMS-3, AND AMS-4)

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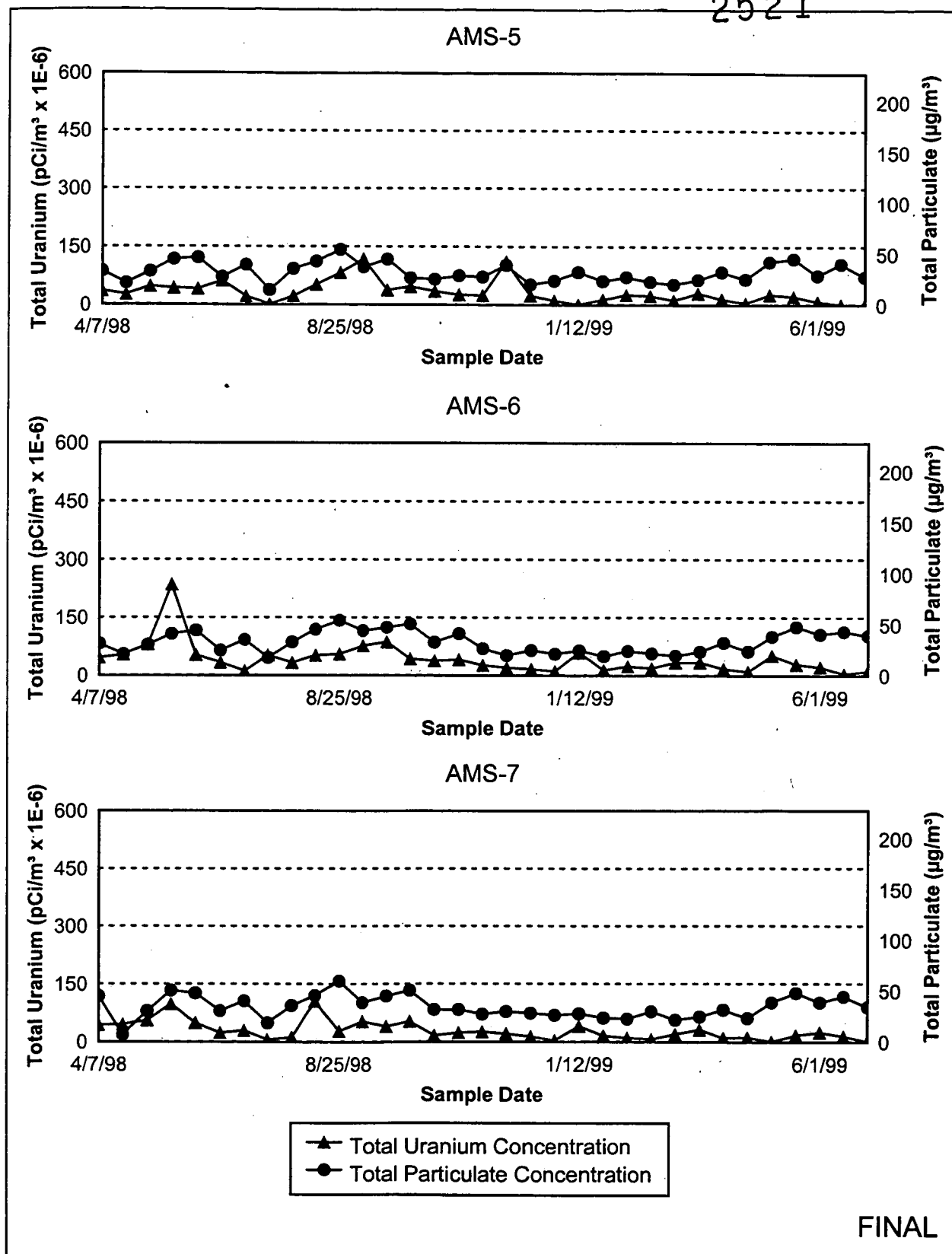


FIGURE 3-5. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-5, AMS-6, AND AMS-7)

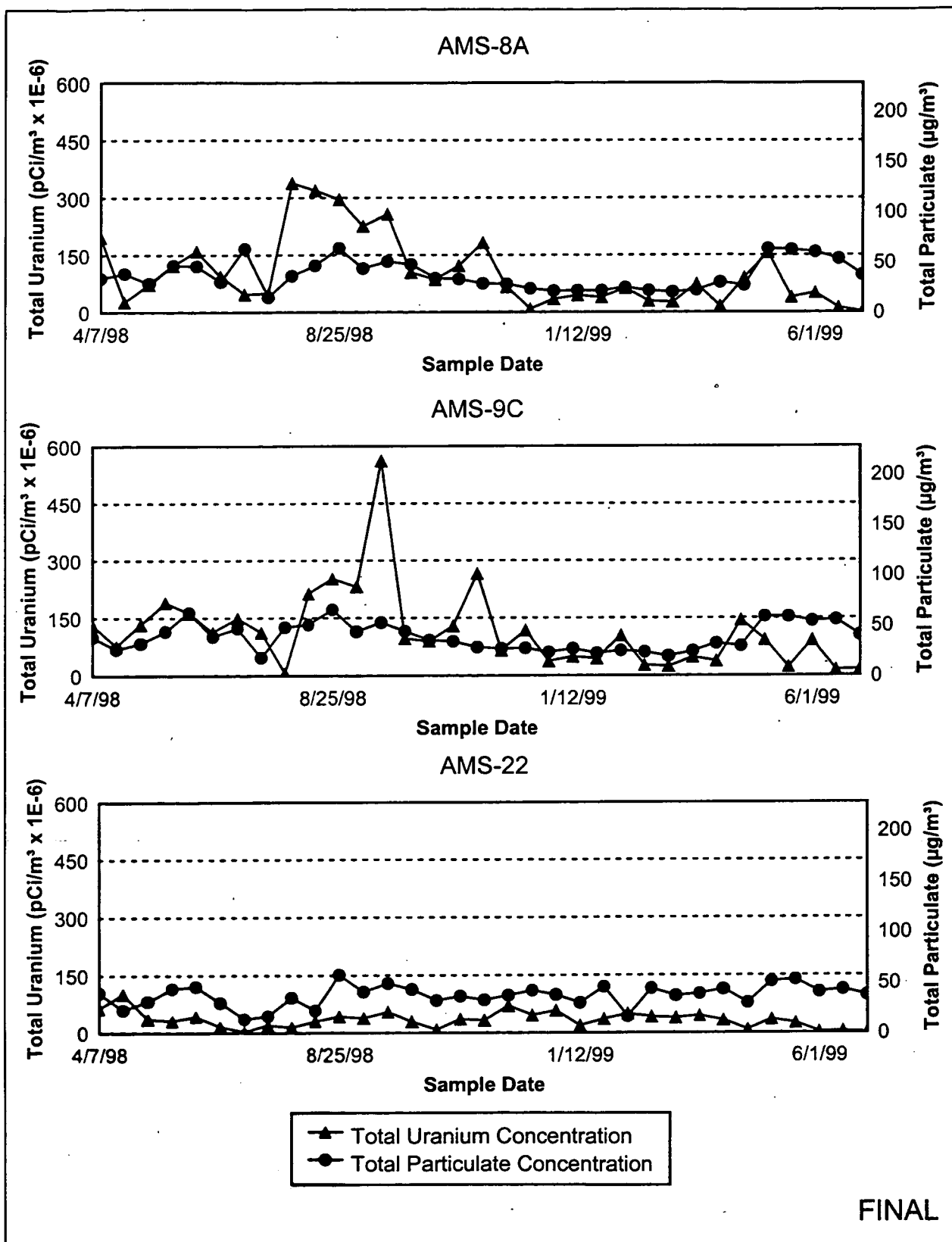


FIGURE 3-6. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-8A, AMS-9C, AND AMS-22)

98

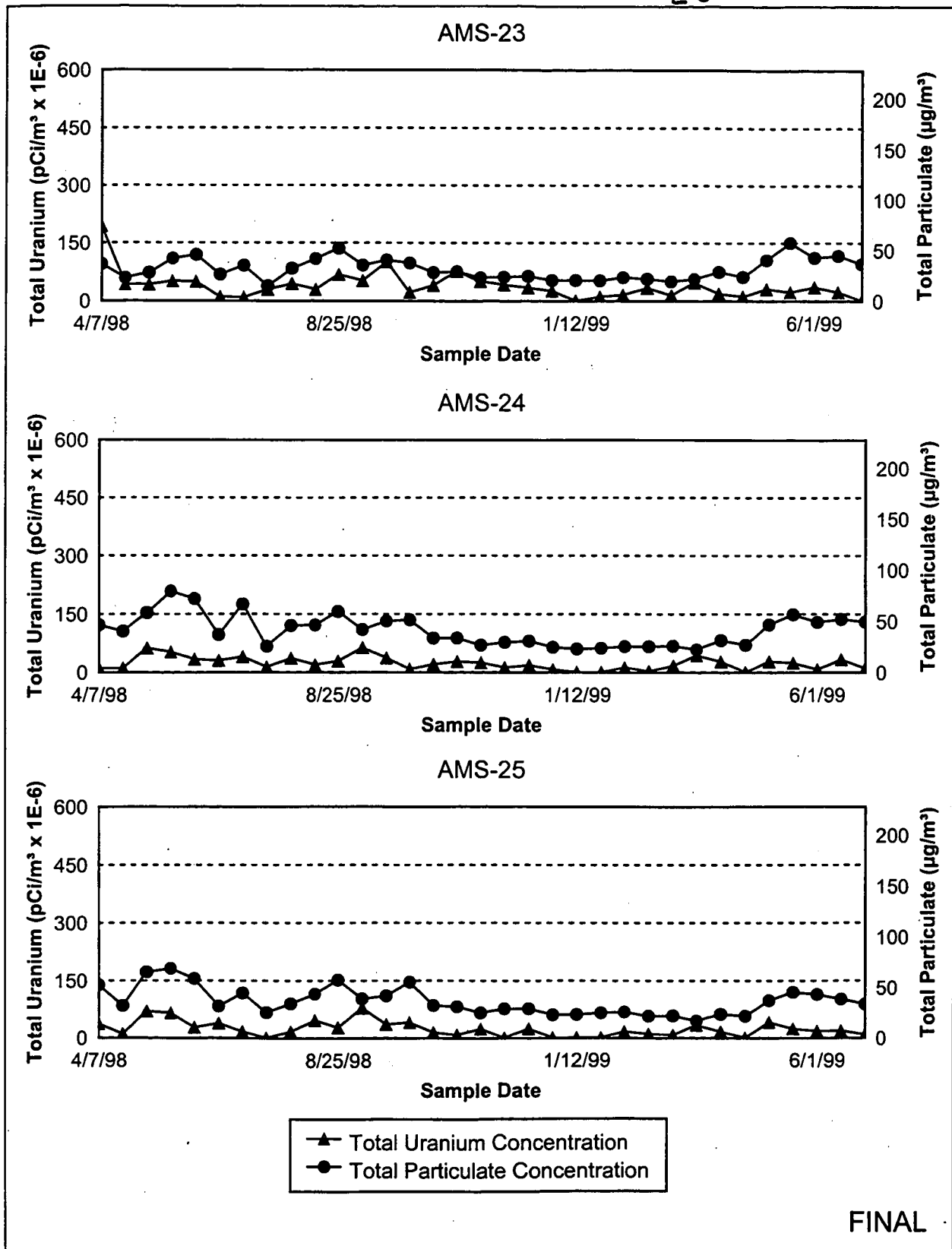


FIGURE 3-7. TOTAL URANIUM AND PARTICULATE  
CONCENTRATIONS IN AIR (AMS-23, AMS-24, AND AMS-25)

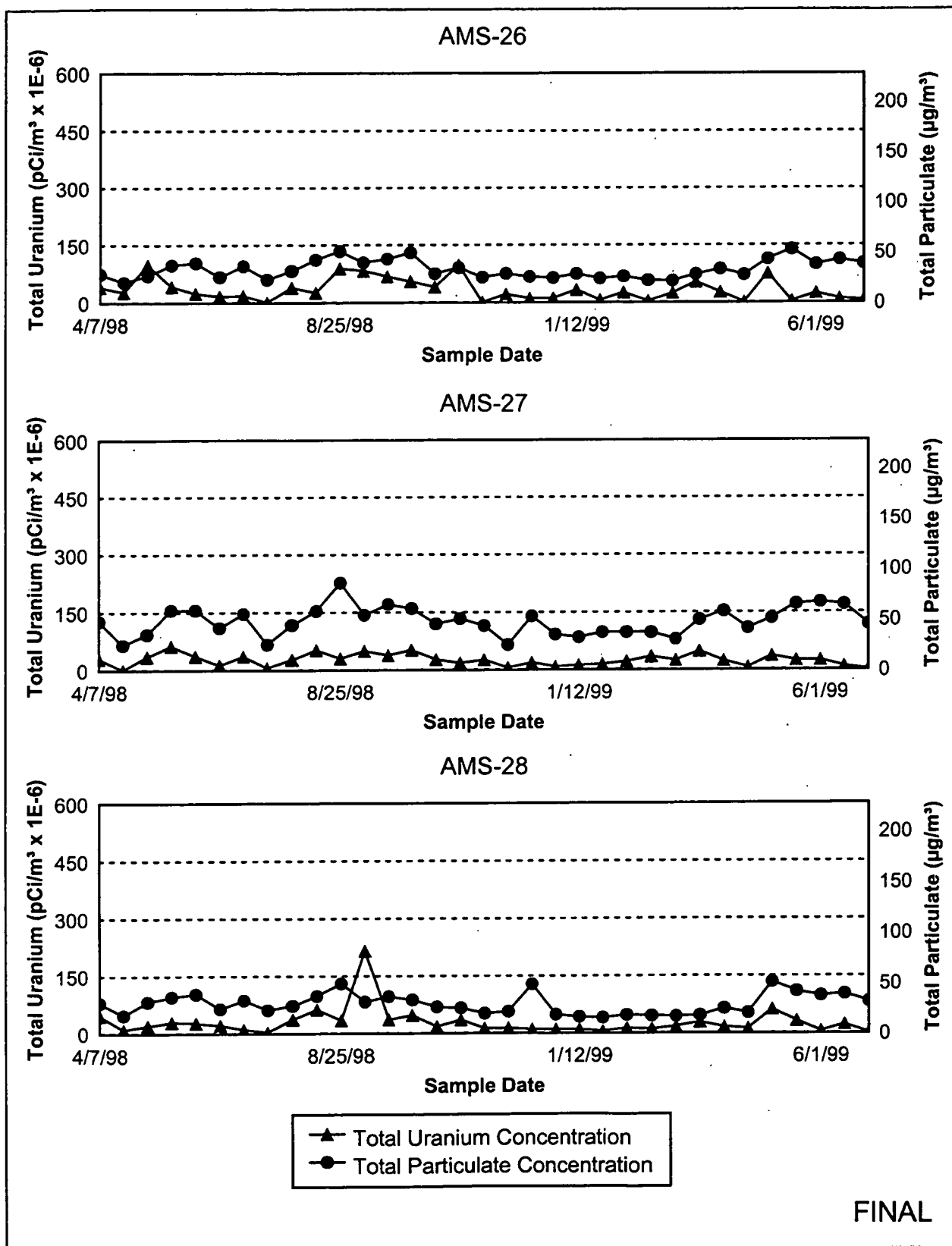


FIGURE 3-8. TOTAL URANIUM AND PARTICULATE  
CONCENTRATIONS IN AIR (AMS-26, AMS-27, AND AMS-28)

186

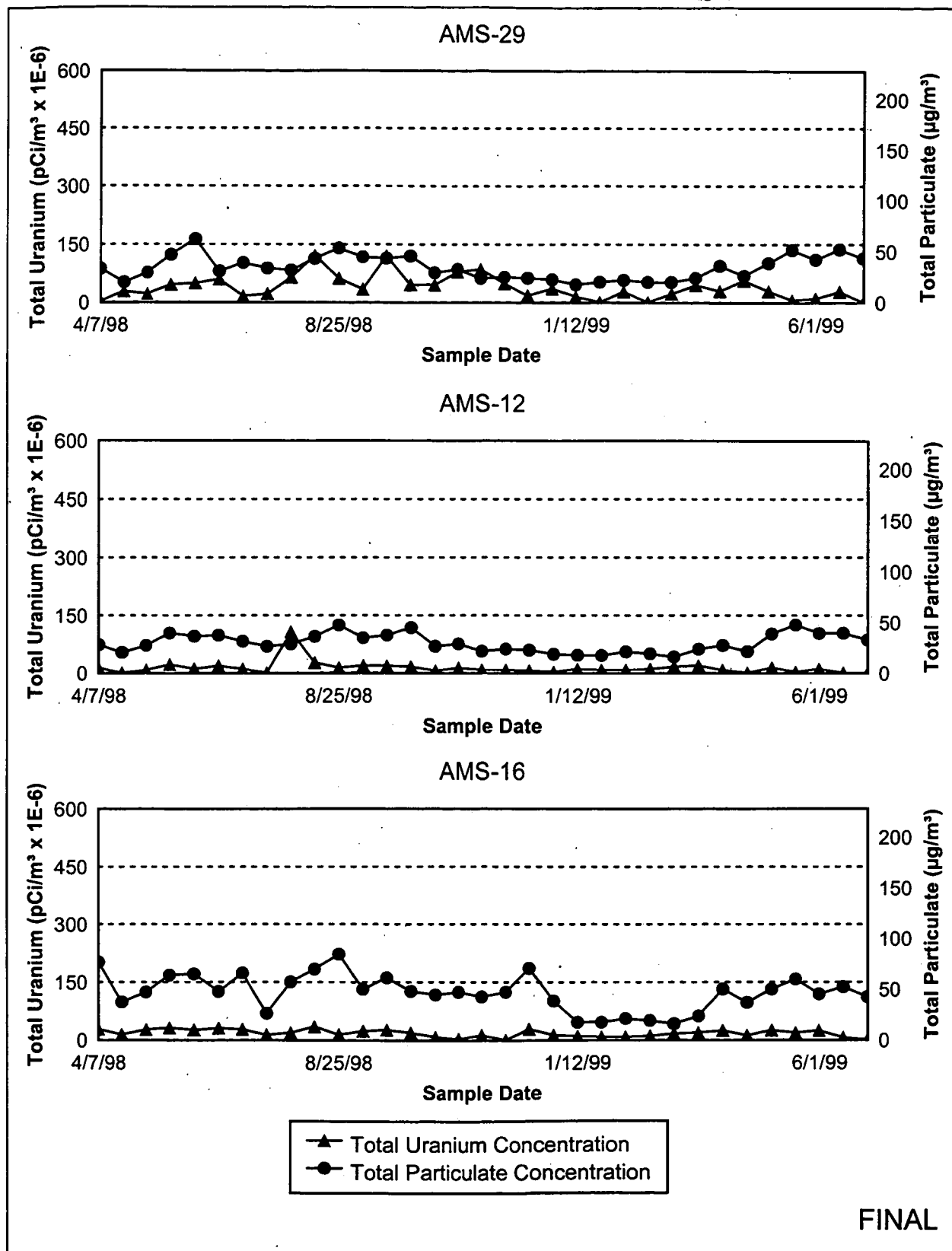


FIGURE 3-9. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-29, AMS-12, AND AMS-16)

161

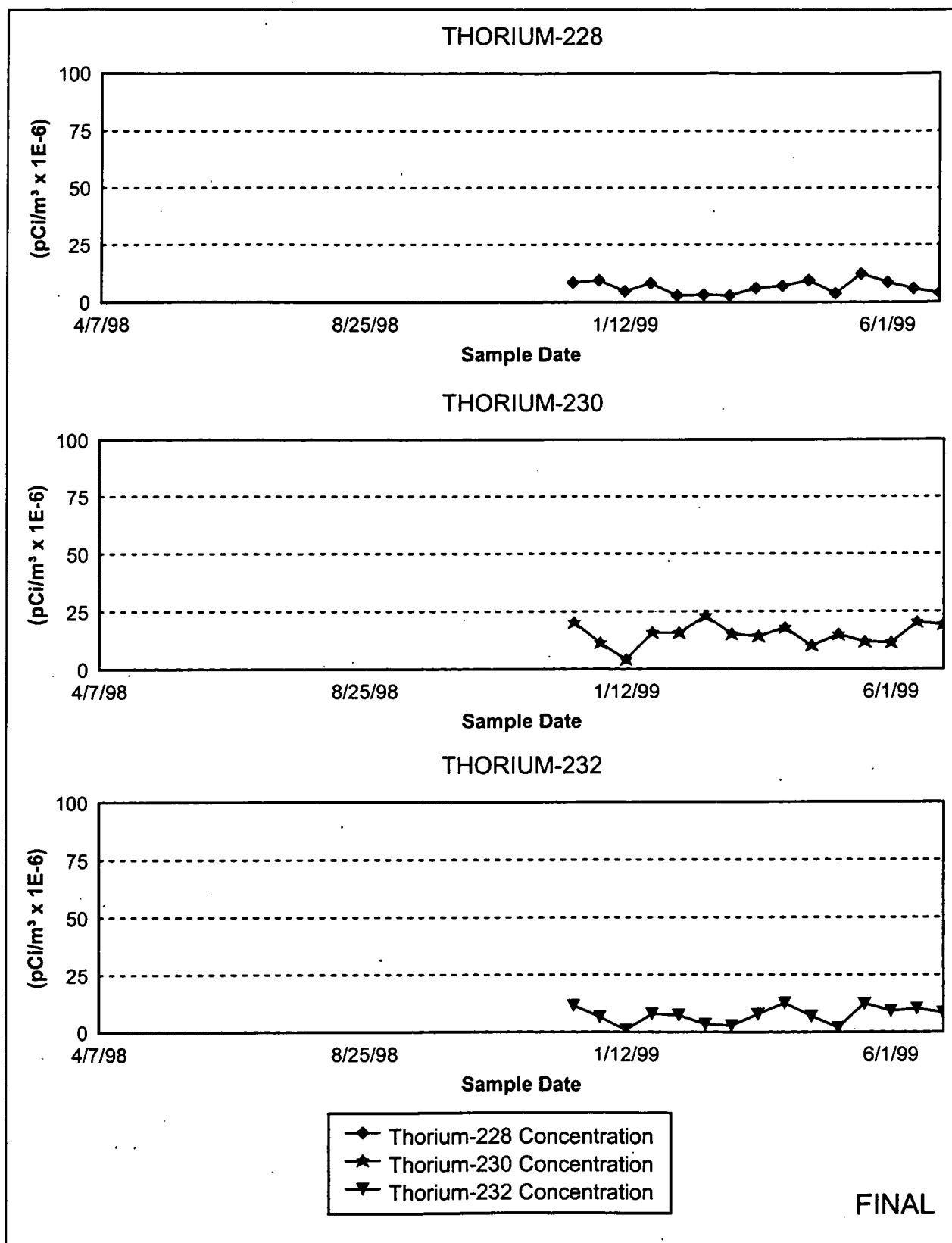


FIGURE 3-10. THORIUM-228, THORIUM-230, AND THORIUM-232  
CONCENTRATIONS IN AIR (WPTH-1)

102

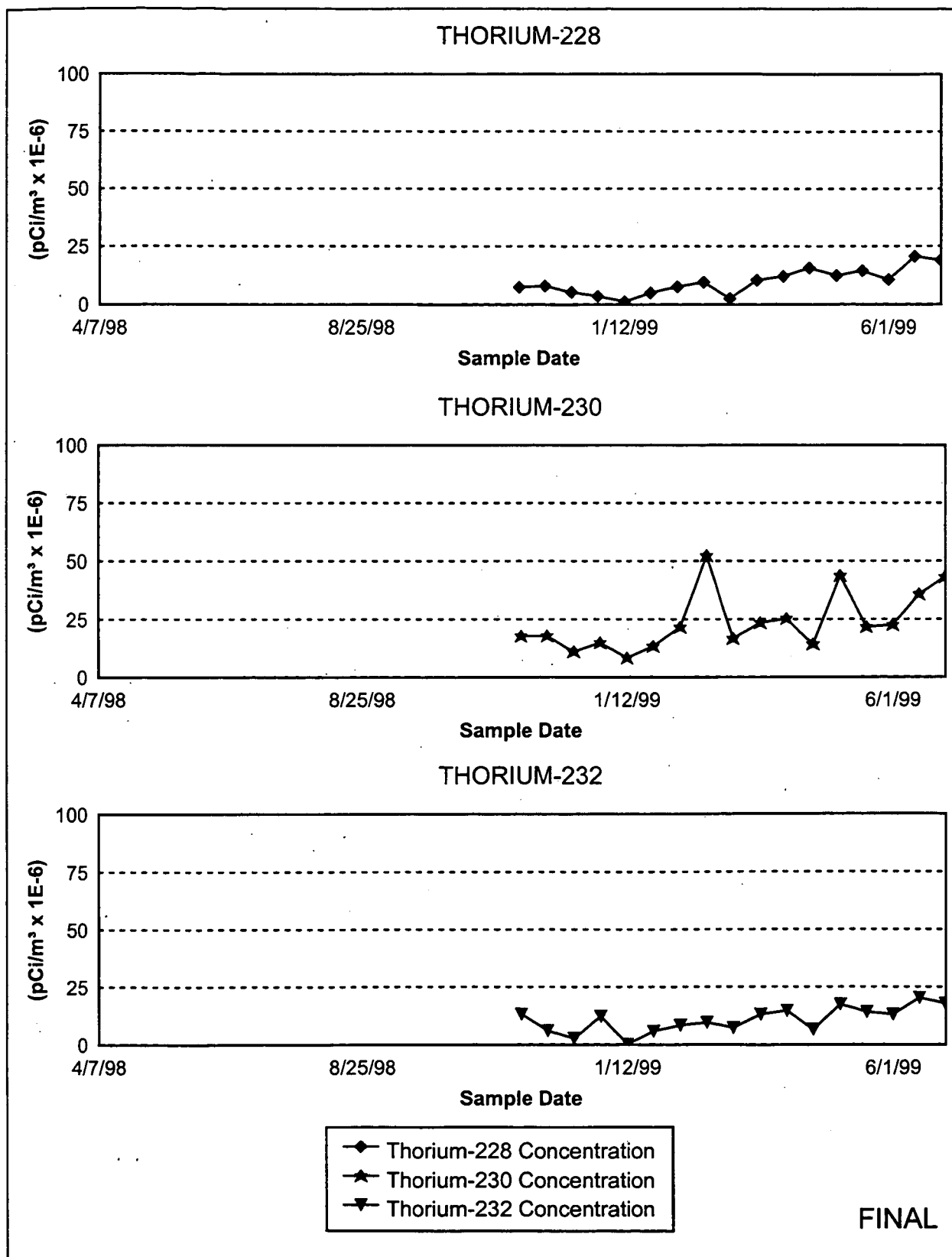
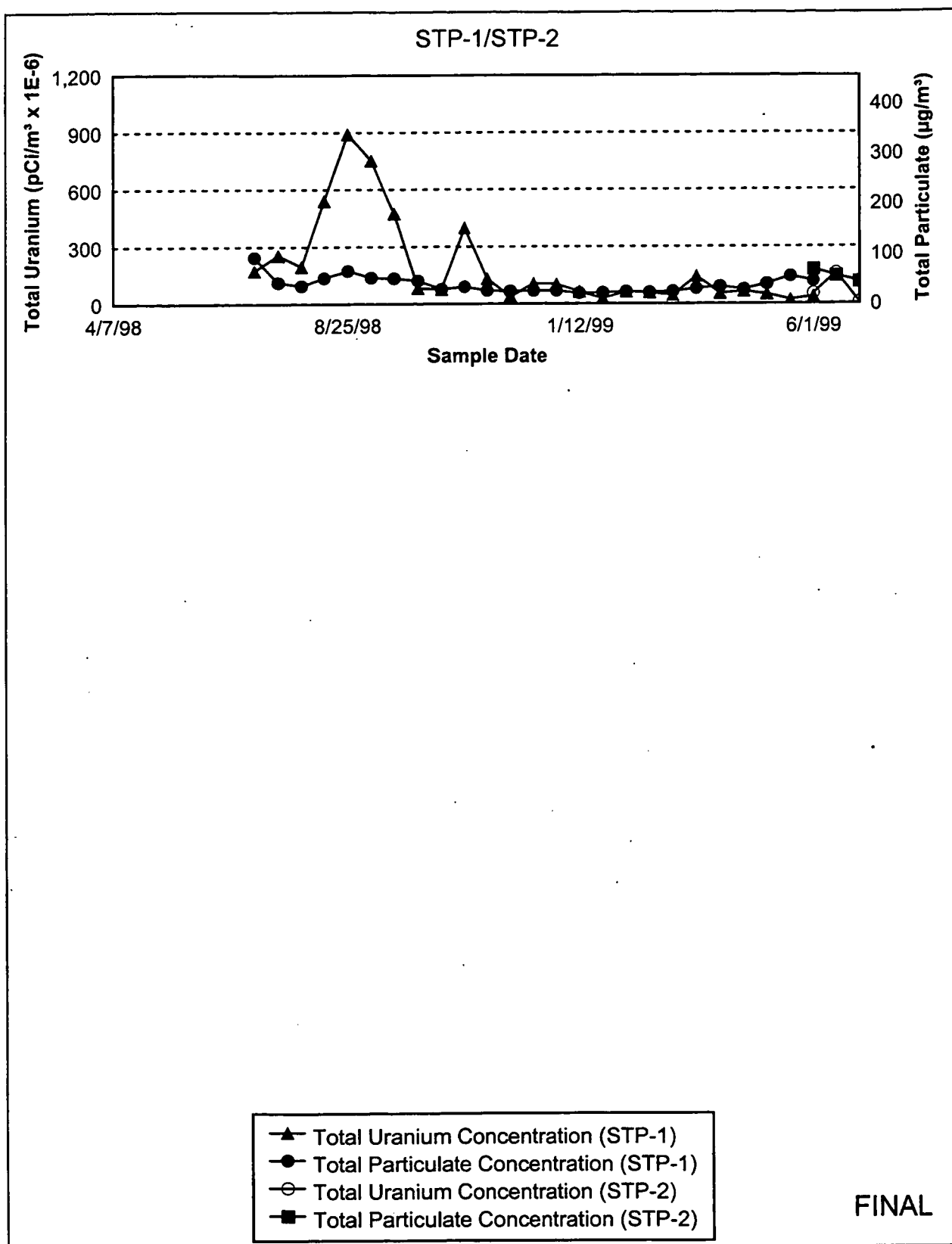


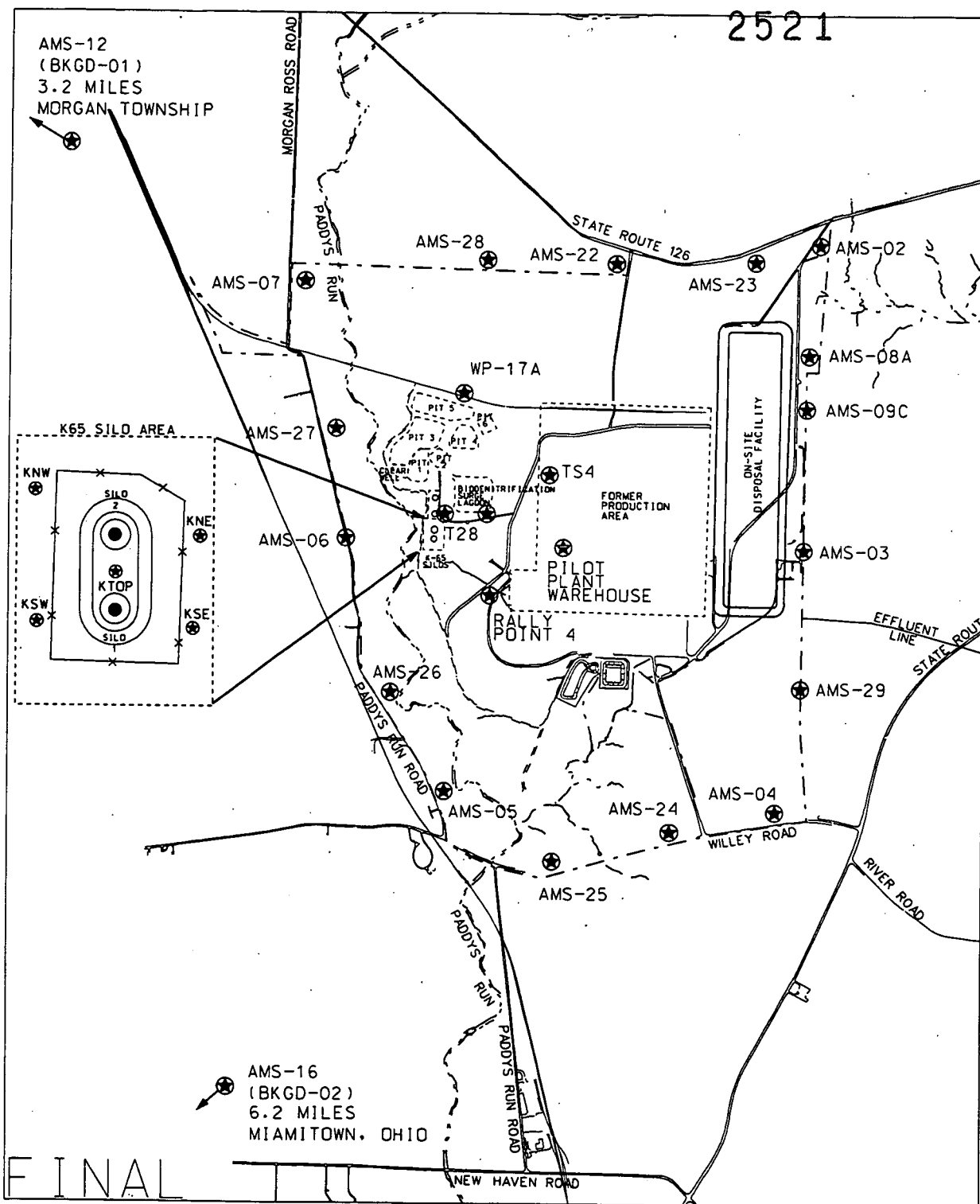
FIGURE 3-11. THORIUM-228, THORIUM-230, AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-2)

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**FIGURE 3-12. TOTAL URANIUM AND PARTICULATE  
CONCENTRATIONS IN AIR (STP-1/STP-2)**

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LEGEND:

----- FEMP BOUNDARY

★ ENVIRONMENTAL RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

★ DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

● SILO HEAD SPACE RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

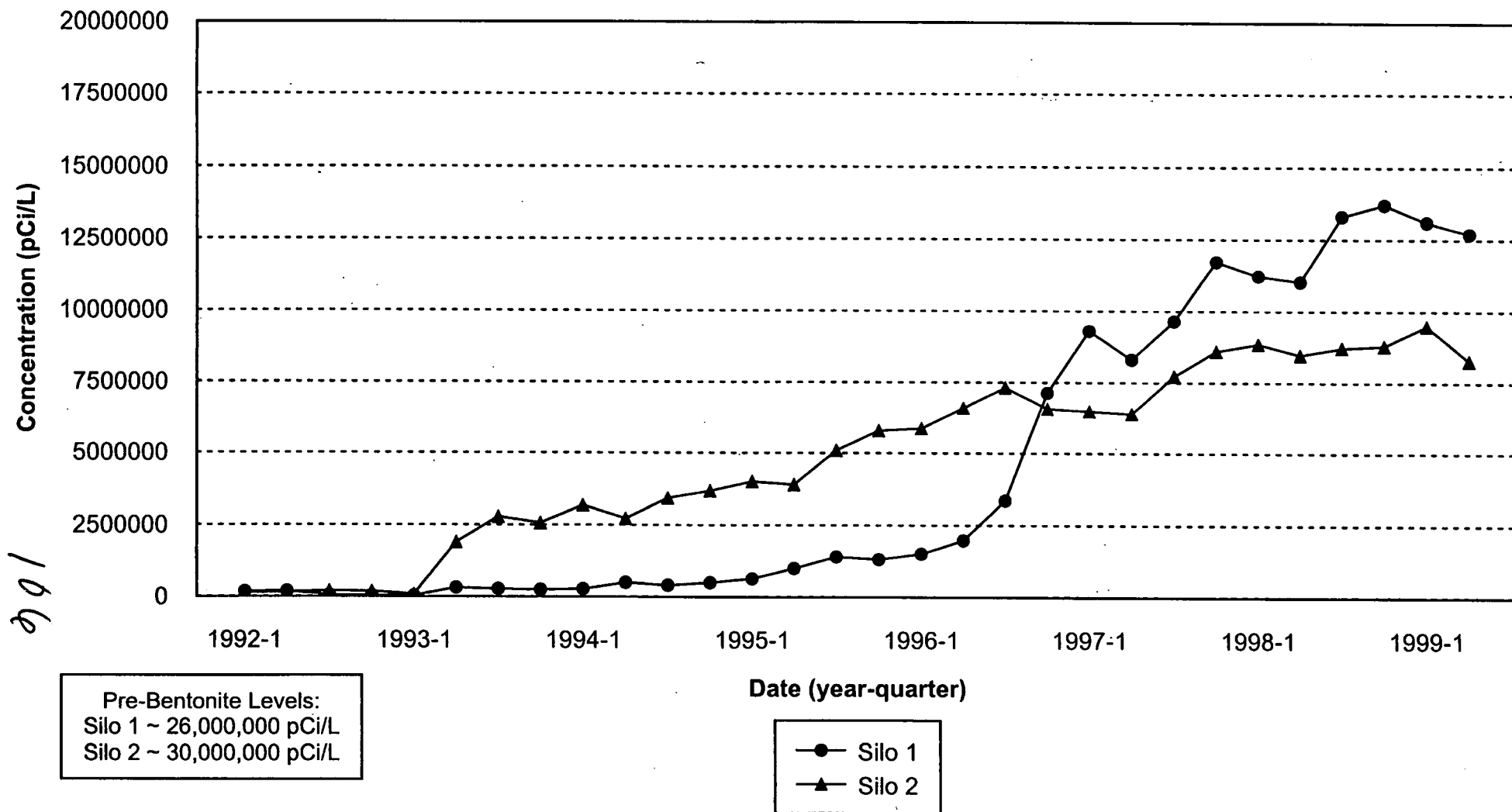
SCALE



2000 1000 0 2000 FEET

FIGURE 3-13. RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATIONS

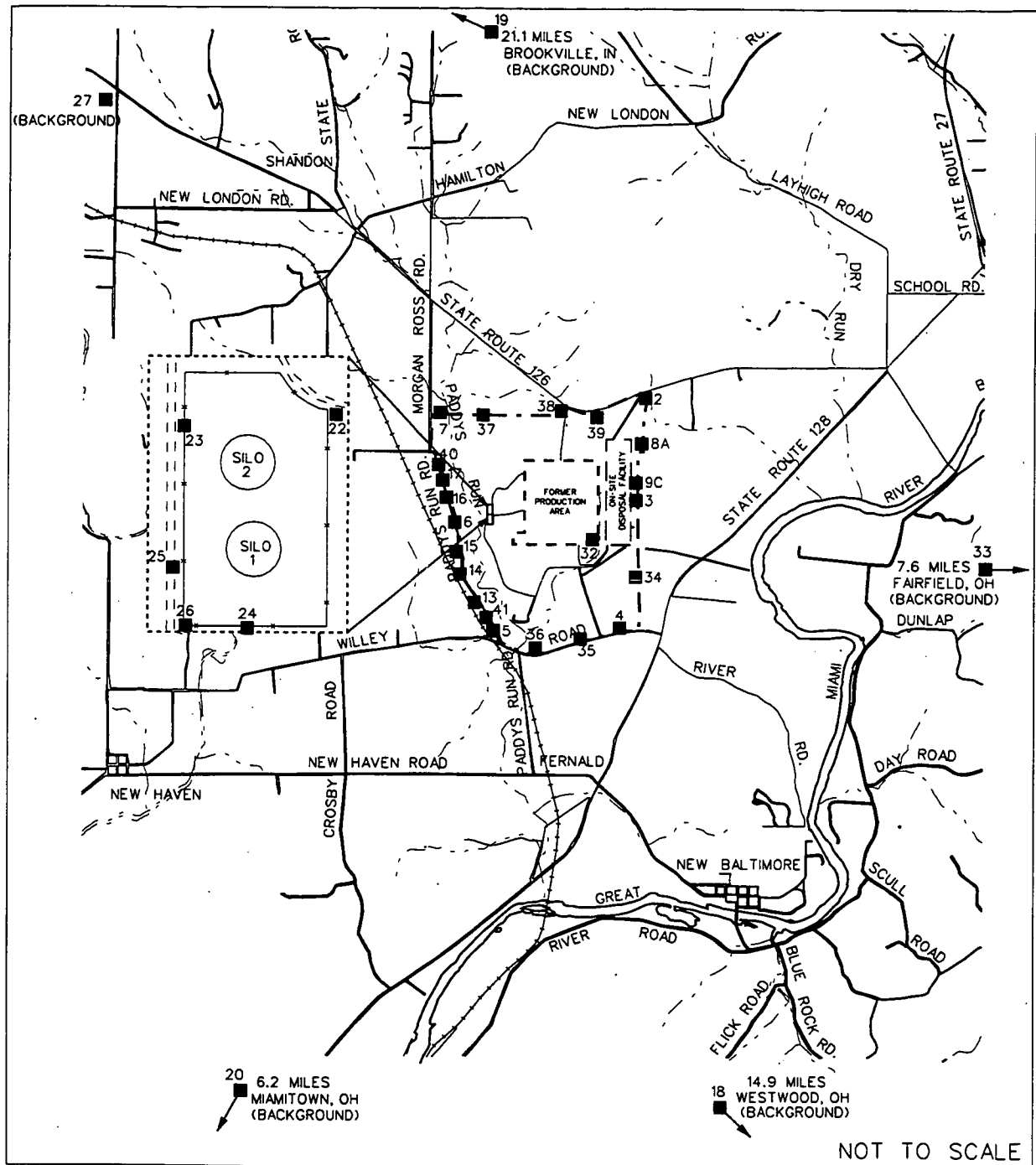
105



NOTE: Defective sample line for Silo 1 was replaced during fourth quarter 1996.

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FIGURE 3-14. QUARTERLY K-65 SILO HEAD SPACE RADON CONCENTRATIONS, 1992-1999



## LEGEND:



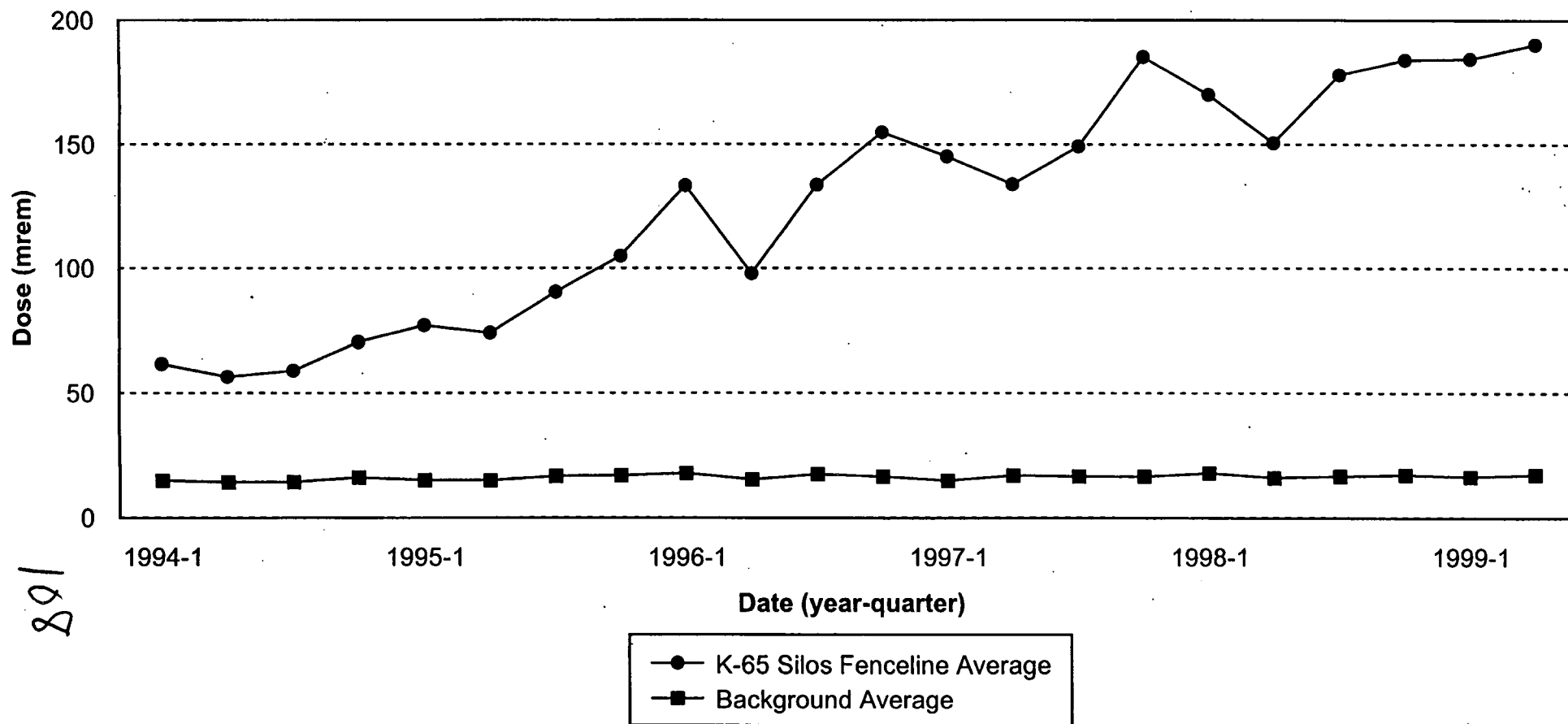
DISTANCE FROM CENTER  
OF FORMER PRODUCTION AREA  
TO SAMPLE LOCATIONS OFF MAP

--- FEMP BOUNDARY

■ DIRECT RADIATION (TLD)  
MONITORING LOCATION

FINAL

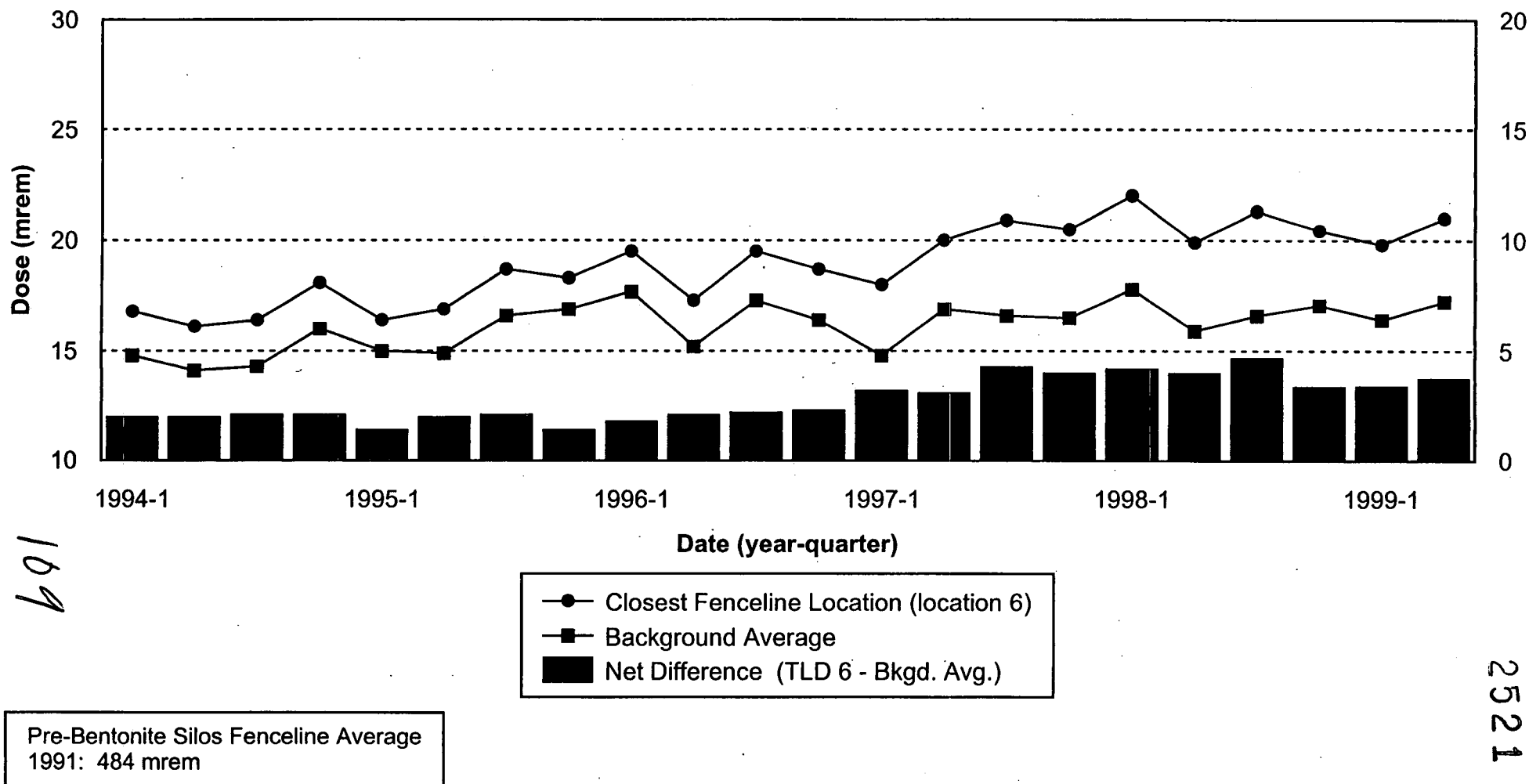
FIGURE 3-15. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER)  
MONITORING LOCATIONS



Pre-Bentonite Silos Fenceline Average  
1991: 484 mrem

FINAL

FIGURE 3-16. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994-1999  
(K-65 SILOS FENCELINE AVERAGE VERSUS BACKGROUND AVERAGE)



FINAL

FIGURE 3-17. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994-1999  
(LOCATION 6 VERSUS BACKGROUND AVERAGE)



FIGURE 3-19

AIR SAMPLING ACTIVITIES COVERED IN THE NEXT QUARTERLY REPORT

1999											
First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
SAMPLING ACTIVITIES	Radiological Particulate Monitoring:					◆	◆	◆			
	NESHAP Quarterly Composite							◆			
	Radon Monitoring - Continuous Alpha Scintillation Monitors					◆	◆	◆			
	Direct Radiation (TLD) Monitoring							◆			
NESHAP Stack Emissions Monitoring						◆	◆	◆			

◆ Data summarized/evaluated in the next report

FINAL

## 4.0 NATURAL RESOURCES UPDATE

This section provides a summary of newly impacted or ecologically restored areas, as well as a status of wetlands and endangered species at the FEMP.

During the second quarter of 1999, no habitat impacts were caused by field activities, but ecological restoration efforts continued. These projects consisted of wetland mitigation efforts and three projects conducted as part of the environmental projects required under a dispute resolution agreement between DOE, EPA, and OEPA for missed Operable Unit 4 milestones (EPA 1997). A description of each project follows.

Wetland mitigation efforts continued in Area 1, Phase I during the second quarter of 1999 in order to partially fulfill DOE's 16.5 acre mitigation requirement. In this area a formerly grazed pasture was converted to a 12 acre ecosystem containing eight wetland basins which are connected by gravity flow streams. The wetland portion of this ecosystem comprises approximately seven acres. Vegetative cover (forest, shrubland, prairie, marsh) was established for both wet and dry conditions. This project involves extensive grading and planting of over 3,000 shrubs and trees and 30 species of grasses and wildflowers native to southwest Ohio. Approximately 60 percent of the vegetation was planted by June, with the remainder to be planted in the fall.

The Invasive Plant Control Research Project also continued in Area 1, Phase III during the second quarter of 1999. This project is being conducted under an ecological research grant as part of the Operable Unit 4 dispute resolution agreement. After a plant survey was conducted by Ohio University in Area 1, Phase III, eight plots were established in order to test the effectiveness of several chemical and mechanical control techniques for the invasive amur honeysuckle (*Lonicera macii*). To evaluate how planted vegetation would respond to these techniques, tree seedlings were planted throughout every plot. The species planted included black walnut (*Juglans nigra*), green ash (*Fraxinus pennsylvanica*), chinquapin oak (*Quercus muehlenbergii*), black cherry (*Prunus serotina*), redbud (*Cercis canadensis*), and flowering dogwood (*Cornus florida*). These species were selected because they are appropriate to the habitat and are native to southwest Ohio. Half of the seedlings planted received tree tubes to investigate the effects of deer browsing. These plots will be monitored over the next four years to evaluate tree seedling growth and survival against each technique, along with the rates of native and invasive plant

volunteering within the plots. The final product of this research will be management recommendations for the control of invasive plant species at the FEMP.

The Area 8, Phase I Re-vegetation Research Plots Project also continued as part of the Operable Unit 4 dispute resolution agreement. This project involved planting 300 saplings and 2,400 seedlings within six 25 by 50 meter plots in Area 8, Phase I. Two plots were planted with saplings only, two with a combination of saplings and seedlings, and two with seedlings only. Two additional plots were established as a control. Tree species that were planted included chinquapin oak (*Quercus muhlenbergii*), hackberry (*Celtis occidentalis*), black walnut (*Juglans nigra*), green ash (*Fraxinus pennsylvanica*), and Ohio buckeye (*Aesculus glabra*). These species were selected based on availability and their appropriateness to the habitat. Because the chinquapin oak seedlings did not arrive in time, they will be planted in the fall. Researchers from Miami University will measure survivability and growth over the next four years to determine the optimal combination of tree sizes and densities for use in future restoration efforts at the FEMP. Tree tubes and repellants will also be used to investigate the effects of deer browsing.

A prairie planting in an undisturbed area of the FEMP was also required under the Operable Unit 4 dispute resolution agreement. Like the re-vegetation plots described above, this project was established in Area 8, Phase I. Approximately 2.5 acres of formerly grazed pasture were cleared of existing vegetation (with herbicide) and seeded with native grasses and wild flowers during the second quarter. Half of the prairie was also seeded with oats to determine the effectiveness of a cover crop during prairie establishment. Continued management of the prairie involves periodic mowing to control weeds. Over time, this area along with re-vegetation plots will provide attractive viewing area for the FEMP Ecological Restoration Park.

As specified in the IEMP, Revision 1, the Sloan's crayfish (*Orconectes sloanii*) population in Paddys Run was surveyed during June 1999. Crayfish were collected with a minnow seine at 10 sites along the upper on-property reaches of Paddys Run. After species, sex, and life stage were identified, the crayfish were released. Of the 178 crayfish collected, 117 were Sloan's crayfish and 61 were rusty crayfish (*Orconectes rusticus*). The vast majority of Sloan's crayfish collected were juveniles (102).

While the percentage of Sloan's crayfish collected was slightly lower than during the last survey in 1996, the large proportion of juveniles suggest successful breeding among the Paddys Run population.

There were no unexpected conditions observed in Paddys Run during Sloan's crayfish monitoring in the second quarter of 1999. However, there was one observation of increased turbidity in the northern drainage ditch during April 1999. On Friday April 9, the FEMP received 1.08 inches of precipitation in the early morning hours. Field observation later that day revealed that runoff from the northern drainage ditch appeared more turbid than water in Paddys Run. The flow from the drainage ditch quickly mixed with the Paddys Run flow but no visible increase in turbidity was evident downstream of the outfall. A follow-up field observation on Monday April 12 revealed that turbidity in the northern drainage ditch had decreased. Paddys Run flowed clear, and no further action was required. Other than that, no FEMP-induced increase in turbidity above ambient conditions was observed. Therefore, no FEMP activities have adversely impacted the Sloan's crayfish population during the second quarter of 1999.

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